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[Special Editorial Correspondence.]

Seventh Annual Meeting, Pacific Coast Gas Association.

SAN FRANCISCO, CAL., July 20th, 1899.

Dear JOURNAL: The seventh annual meeting of the Pacific Coast Gas Association was, so far as its technical side is concerned, satisfactorily brought to a close yesterday. The members and their guests had the comfort which comes with typical California weather, when the latter is at its best, the meeting room was in the handsome and well arranged offices of the San Francisco Gas and Electric Company, the attendance was excellent, the attention of the members to the proceedings was continuous, and the social features were of the pleasantest, most cordial and fraternal sort. The latter included a banquet on the evening of Wednesday, the 19th inst., the direction of which was in the hands and by the voice of "Joe" Crockett as toastmaster. He did not seem to care whether or not the Supervisors of San Francisco decreed that gas should be given away in the "old gold" city, but he certainly did know that no coffin had yet been made of sufficient depth and strength to confine the joys of the Coast's gas men when assembled in annual reunion. The meeting was called to order, the morning of the 18th inst., by the President, Mr. Charles F. Adams, of Portland, Ore., who had the satisfaction of addressing, in his inaugural message, a set of associates that thoroughly agreed in his expression of ideas that ownership and operation of works concerning the public could be best carried out when their direction was in private hands rather than under municipal control. In fact, Mr. Adams went so far as to claim that municipal direction of enterprises that have their life in the people is a positive indication of imperialism. And the claim would seem to be well founded, in that the desire for gain on private account can always be checked through opposition, whereas the imperialistic municipal owner, in slow process of law, will have no opposition, since the law that created such ownership is of home making. The address of President Adams will be well worth reading when it comes before your readers in the regular way. The paper list was curtailed by the failure of Mr. Oscar B. Weber, of New York, to present or read the topic which appeared in your official notification under the designation of "Title to be Announced," and by the neglect of Mr. L. Kahn to forward his story respecting "Gas Stoves, from Foundry to Consumer." The excuse urged on behalf of these delinquents was that likely both were too busy to redeem their pledges. On the other hand, the paper list was lengthened by contributions from Mr. Leon P. Lowe and by Secretary Britton. Mr. Lowe wrote interestingly and graphically on the value of gas lighting by means of incandescing agents, and Secretary Britton wrote, as is usual with him, sincerely and convincingly on the subject of how gas companies should best serve their customers and themselves in their dealings with municipalities. The other regular papers promised came to hand, for I presume the one by Mr. L. P. St. Clair, Superintendent of the Bakersfield (Cal.) Gas and Electric Light Company, on "The History of a Gas Plant," may be accepted as regular, although it failed to "show" in your "official notices" of the meeting. The paper proved a most interesting one, in that it detailed the troubles which afflict gas men in Coast pioneering districts; troubles quite unknown to those who have served their apprenticeship in the East.

Mr. J. B. Grimwood's paper on the "Ignition of Gas by Chemical Means" was quite in line with his prior scholarly communications to the Coast Association; and its lines showed that he had put into its preparation much of time and research. And a like statement applies to the paper by Mr. John L. Howard, on the burning subject of the "Fuel Question in California." These papers all brought out good discussions. It might not be out of the way, however, to assert that the convention was quite in earnest when it listened to and discussed the paper on "Electrolytic Trials," prepared and submitted by Mr. Wm. A. Aldrich, the valiant Secretary of the Spokane Falls (Wash.) Gas Light Company. Aldrich and his Company are very much in earnest over this matter, and their joint determinations thereon cannot fail to be of value to the fraternity as a body. Editor Hollidge gave a good running account of his "Wrinkle" collection, which amounted to no less than 32 numbers, and Editor Clements rounded out the technical side of the sessions in good form with an interesting batch of "Experiences." The new members elected were: C. L. Arques, Asst. Secretary, San Jose (Cal.) Light and Power Company; O. F. Alstrom, Supt. St. Helena Gas Company; E. H. Brouse, Supt. Hollister (Cal.) Light and Power Company; John Martin, Supt. Yuba (Cal.) Power Company; and James English, Secretary of the Vancouver (B. C.) Gas Company. The election of the latter puts the Association in the way of shaking hands with our mother country and suggests the scope of the territory to which we may look for members. In fact, Mr. English's election brought out the remark that remembering the annexation of Hawaii and the Philippines, it is not without the bounds of possibility that in due time representatives of gas companies in these our latest acquisitions will be members of the Coast Association. The officers chosen were:

President—John Clements, Red Bluff, Cal.

Vice-President—John A. Britton, Oakland, Cal.

Secretary and Treasurer—J. B. Grimwood, San Francisco.

Directors—L. P. St. Clair, Bakersfield, Cal.; W. A. Aldrich, Spokane, Wash.; C. M. Converse, San Francisco; and R. M. Powers, San Diego, Cal.

Mr. G. H. Hollidge was elected Editor of the Wrinkle Department; and Mr. O. M. Gregory was named to collate the "Experiences." Britton would have succeeded himself were it not for the fact that the Association is desirous of having a trial with him in due time as its President. Grimwood, however, is likely to make several straight marks on the Secretary's stationery. The excursion to Camp Taylor to-day (Thursday) was a most enjoyable outing in every sense. The souvenir programme, which has been an annual pleasure to the members of the Association, this time comprised a handsomely bound volume holding pictures of the plants of the Gas Companies represented in the Association, together with a ground plan of each, the illustrations being accompanied by tabulated statements of the growth of each Company from the date of its organization to to-day. No matter whether or not I repeat myself, I wish to go on record as declaring that the meeting was a success, that our hosts were hosts indeed, and that if such fraternal companionship as was manifested this week in San Francisco can be maintained, the organizers of Equitable companies might better retire forthwith and permanently to the mid-western fields from which their working capital has so far been obtained.—O. N. T.

NOTES.—The Proprietors of the Logan Iron Works, of Brooklyn, N. Y., have been awarded a contract for the construction of a gasholder, to rest in steel tank, the same to be erected in Merida, the capital of Yucatan, Mexico. The Logan Company also has contracts in hand, covering the erection of storage holders, to rest in steel tanks, at Memphis, Tenn., and Hamlin, N.C. In fact, their present contracts in the holder line are seven in number.——At the annual meeting of the Baltimore Consolidated Gas Company the officers chosen were: Directors, E. C. Benedict, E. A. Jenkins, J. E. Hurst, Jno. W. Hall, James A. Gary, G. A. von Lingen, W. F. Burns, W. W. Spence, W. F. Frick, D. D. Mallory, Bernard Cahn and N. W. James; President, J. W. Hall; Vice-President, James A. Gary; Treasurer, Joseph W. Clarke; Secretary, N. T. Meginnis.——At the annual meeting of the owners of the Municipal Gas Company, of Albany, N.Y., the Directors chosen were: Anthony N. Brady, Robt. C. Pruyn, William McEwan, John A. Delehanty, Horace G. Young, John Bowe and John G. Myers. ——It is reported that the gas properties of Haverhill, Mass., are to be sold to a syndicate of capitalists, headed by Mr. Thomas Nevins, of Newark, N. J.——Messrs. A. M. Byers & Co., pipe and tube manufacturers, of Pittsburg, Pa., have signed the schedules of the Amalgamated Association. Heretofore the Messrs. Byers have opposed the pipe rust.

[Prepard for the JOURNAL.]

Gas Pipe Fitting and Engineering.

By MECHANICAL ENGINEER.

Pipe Clamps.—Several types of pipe clamps are in use by gas pipe fitters and engineers, some of the principal of which are shown in the accompanying sketches. Ingenious forms of these are designed to secure compression on the pipe by means of conical sleeves, wedges or similar mechanical devices; but as a rule the gas engineer prefers the simplest descriptions of split clamps in which the strain on the bolts acts directly to produce compression. The simple marine clamp, in two sections, is shown in Fig. 1, while the three-section style is presented in Fig. 2. The idea of increased sections is that a larger number of points receive the pressure than if fewer sections are used. In the plain clamp (Fig. 1), for example, the points *A A* represent two fulcra, and the compression falls mainly upon these points, acting after the principle of a ring shrunk over the pipe. If the three-section clamp is used the process of tightening the separate flanges tends to distribute the pressure at an increased number of points, *B B B* representing the fulcra. It is possible, therefore, to secure a firmer packing, because the bolts in the flanges of the separate sections can be tightened according to the circumstances.

The four-section clamp is shown in Fig. 3, and in this pattern the letters *C C C C* represent four fulcra, and the pressure falls at a further increased number of points on the pipe.

Clamp Couplings.—There are occasions in gas pipe fitting and installing when clamp couplings are required. These forms of couplings are not provided with flanges for bolting, but are constructed on the box principle, as shown in Figs. 4 and 5. Two annular shells are shaped and arranged for connection by diaphragms. The point in favor of these couplings is the economical method of manufacture, the cost being much less than either flanged couplings or special conical or sliding-sleeved kinds. They can, therefore, be purchased at comparatively low prices. An important point in these couplings concerns the boring of the bolt-holes, which should be as nearly uniform as possible. The best plan to obtain accuracy is by using a template when boring, which device may be turned over for drilling the different halves, thus assuring the holes in each half to be alike.

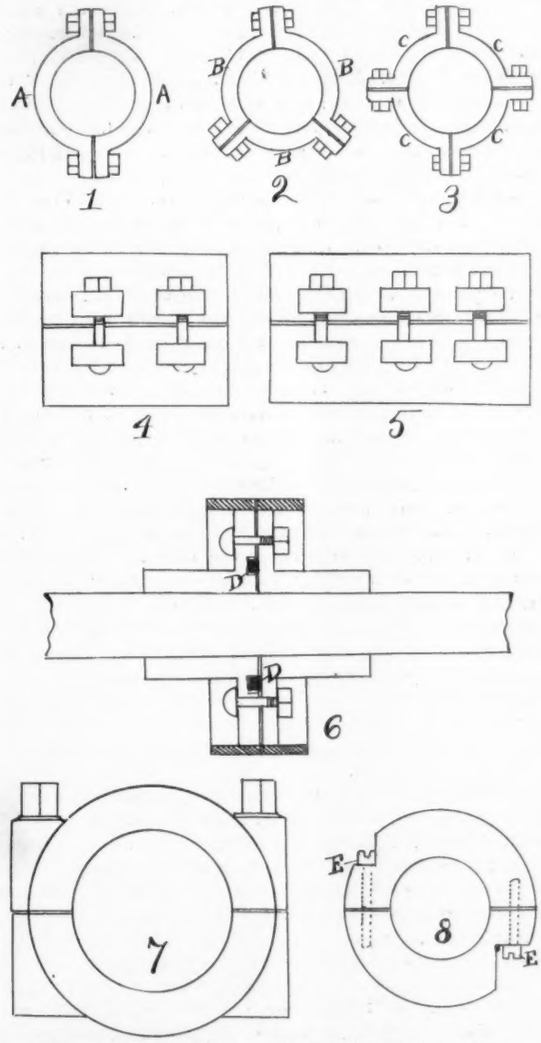
Flanged Clamps.—Owing to the cost of making flanged clamps, one of which is shown in section in Fig. 6, these clamps are used only for special service. A mistake often made in turning these clamps is in using an ineffective interlock, or no interlock at all. The interlock is marked *D D* in the drawing, and should be used in all clamps of this type, otherwise the setting of the clamp will shift slightly and weaken the connections, and, perhaps, result in working loose from its position on the pipe line. The web plates are also important, and should be finished off true. As the clamping bolts are usually bored when the sides are together, the drilling usually proves uniform. The writer has found these clamps in a non-effective condition due to the use of one or more bent bolts in uniform holes. The employment of bolts of a fraction smaller diameter than the bore is also very detrimental to the good service of these clamps. Lock-nuts are not needed on the bolts, but care should be taken that the single nuts mesh firmly with the threads of the bolts, and that each nut sets evenly on its seat.

Split Flanges.—Another form of flange which is quite extensively used in gas pipe service comes in the shape of a split flange or collar. These are shown in Figs. 7 and 8. They are of value in places wherever it is necessary to use a shoulder-piece, flange or movable collar on gas pipe systems. The ordinary descriptions are turned down from cast iron, steel, malleable iron or brass. The cost of brass, however, limits the use of this metal in these collars to the smaller sizes, or in cases which require a particularly hard metal. The heavier kinds of collars are chiefly malleable iron. The type of split collar in Fig. 7 is cast in separate sides and the bore for the pipe reamed out. The bolt holes are then drilled and the under half tapped for the threads of the bolts, by which means the sides are closed. The other style of collar, Fig. 8, is a turned ring, and recesses are cut out at opposite sides in the circle to receive the fastening bolts *E E*. This is a very handy little split collar, and is frequently employed by gas pipe fitters.

The pattern of flange shown in Fig. 9 is used mainly for packing purposes. The packing consists of rubber, hemp, cotton, leather or patent compositions, and is packed in at *A A*, receiving the pressure of the opposing flanges as the shell of one is forced into that of the other.

Flanges for the largest sizes of wrought iron gas pipes are frequently made without either bosses or bolts, in which case the gasfitter often finds it difficult to make the proper joints. He sometimes resorts to

boring the parts and rivets the flanges. This, of course, is unworkmanlike, as the next man who has to open the joint will have to use a cold chisel and cut off the rivet heads, perhaps breaking or chipping the metal in the flanges to such extent as to weaken them. When flanges are thus riveted, the only remedy is to shear off the rivet heads, and,



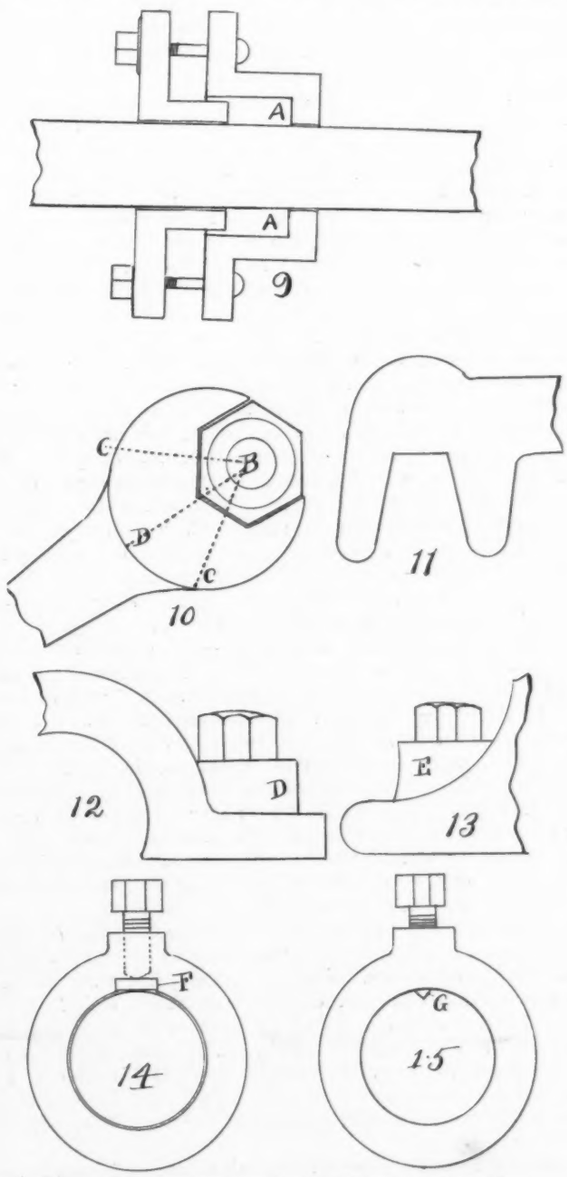
Figs. 1 to 8.—Showing Forms of Clamps for Gas Pipe Service.

when refitting the joint, bore the old holes large enough to receive regular bolts and nuts.

Gas Pipe Fitters' Wrenches.—The ordinary monkey wrench, as used by gasfitters and gas pipe engineers, is not so effective as the common, flat, or S-shaped steel wrenches, one of which is shown in Fig. 10. To get a good and positive grip on the nut or bolt head in a flanged joint in a gas pipe, it is very essential that a non-springing wrench be employed. Monkey wrenches, if large and strong enough, will not spring at the jaws, but as a rule the wrench is used in too light form, or with the jaws spread, something after the fashion of the illustration in Fig. 11. The result is that the wrench does not take hold of the nut or bolt head squarely, and it is impossible to tighten up properly. It has been the custom of the writer to use flat wrenches, like that in Fig. 10, with which the nut can be taken squarely and sufficient force applied to tighten properly without danger of the jaws springing and allowing the wrench to slip off. To make these wrenches, first get the center of the nut, *B*, draw a line to the circle at *D*, which is the radius, and lines *C C*, at an angle of 45°. The point where these lines cut the circle is calculated as the point from which the jaws sweep. The length of the jaws is regulated according to the depth of the nuts or bolt heads intended to be handled. Ordinary tool steel makes a good wrench, the thickness of which ought to be about three-quarters that of the nuts or bolt heads.

Proper Bosses for Screws and Nuts of Gas Pipe Fittings.—As is known to gas engineers, the best types of gas pipe equipments are rendered defective through the employment of imperfect bosses for the screws and nuts employed in the system. I have seen the most costly of elaborate gas pipe installations made unserviceable from this one cause. Screws and nuts for pipe equipments should always be provided with good foundations. The entire symmetry of the line is affected by the bosses, washers and screw heads. In Fig. 12 is shown a good form of seat, at *D*, for the bolt head. This boss is specially provided and is a part of the pipe fixing. In cases where no boss is provided, the bolt head rests unevenly upon the inclined portion of the fixture and in time works loose, even if packed with washers. A good pattern of boss for foundation bolts for bracket work of gas pipes is shown at *E*, Fig. 13. The dimension of these bosses is supposed to be about ¼ inch more in diameter than the nut or bolt head to rest upon it. If required, the parts can be made lighter by coring out below.

Set Screw Fastenings.—A practical way to use a set screw fastening on the shell of a pipe which will not stand much pressure without collapsing, is shown in Fig. 14, which consists in removing the ring or collar and filing in it a flat seat for a key the shape of that shown at *F*. The key should be hard steel, and made to bind slightly on the sides of the key way, so that it will not drop out when freed from pressure between the pipe and the set screw. The point of the set screw rests upon



Figs. 9 to 15.—Concerning Mechanical Operations in Gas Pipes.

the flat key, and the pressure is, therefore, distributed over sufficient area to secure a tight connection without breaking in the pipe. This is much better than the process of setting the screw point direct on the pipe, as would be the case if no flat key were provided, and as is illustrated at *G*, Fig. 15. In the latter case the point of the screw would eventually cut into the pipe and result in leakage or destruction of the pipe through breaking into it.

Recent Experience in the Working of Inclined Retorts.

[A paper read by MR. CHARLES A. CRAVEN, of Dewsbury, England, at the 36th Annual General Meeting of the Incorporated Gas Institute.]

It has become a difficult matter to select a subject for a paper which has not been more or less threshed out; for, to use a proverbial expression, "there is nothing new under the sun." It does, however, seem that there is still room for some further words to be said on "Inclined Retorts;" seeing that an increasing interest is being taken in this important departure from the older methods of coal carbonization.

Some years ago I visited certain works where this system was in operation, and I must say that I was at the time not very much impressed in its favor. Of late years, however, construction and methods of working have been simplified and improved so, that now we, who have been perforce converted into believers, are fully persuaded that we have good and sufficient reasons for the faith that is in us. If you visit a well-constructed corn mill, you find that the grain is first delivered in the upper floor; and as it descends from floor to floor by the inexpensive aid of gravitation, the grain is converted into the primary desideratum—flour—and the bye products are brought to the most convenient position (the ground floor) for their removal. So it is with the coal and its bye-products when dealt with by the inclined retort installations. The system, as it now stands before us, is an efficient, simple, and economical way of dealing with the carbonizing department of a gas works. That such is the case, I hope to show you by the relating of my own experience at the Dewsbury Corporation Gas Works. I shall give you our working for the year 1898; so that you may judge for yourselves how far we have been successful.

First let me say in our old retort house we had 18 beds of through horizontal settings of seven retorts in each bed; the retorts being 20 inches by 15 inches by 19 feet long. Notwithstanding that our system of firing was direct, we succeeded in getting good heats and a good make of gas to the ton. During the year 1896, when the old settings were in exclusive use, we sold, and got paid for, 8 cwt. 3 qrs. 24 pounds of coke per ton of coal carbonized; and this was exclusive of the coke and unriddled breeze consumed in providing steam for boilers, driving exhausters, hauling engine and sulphate of ammonia plant. The chimney shaft is placed in the center of the retort stack. It was decided to pull down the section nearest the railway sidings. The demolition of the old stack, roof, etc., was commenced March 18, 1897. This left us with nine beds of sevens intact, which were calculated to supply all the gas required up to about the middle of the following October. The half section of the house had to be taken up from 20 feet to 50 feet high, the roof replaced, and the inclined retort installation completed ready for actual work by the time named.

Dewsbury Inclined Retort Installation.—The installation consists of eight beds of eight Ω retorts, arches 9 feet 3 inches wide, division piers 18 inches thick, and end piers 3 feet thick, total length 90 feet 6 inches. Height of charging floor, 22 feet above ground level. Height of drawing floor, 9 feet 6 inches above ground level. The retorts are in three lengths 20 feet long over all, Ω-shaped, and tapering from 24 inches by 15 inches at the bottom end to 20 inches by 15 inches at the top end. The producer is at the bottom or drawing side of the bench, so that the hot coke can be delivered direct into the furnace from the retorts. The setting is divided, and the regenerative portion controlled by dampers on each side. The charging floor is composed of steel chequered plates supported by steel girders, secured to the back buckstays and built in the retort house wall. The charging stage is 25 feet wide, and runs the whole length of the new bench. The drawing stage is 16 feet 6 inches wide, formed by rolled joists, with red brick arches between filled in with concrete and paved with firebricks on edge. The girders are supported by the front buckstays and cast iron standards fixed to clear the railway which takes coal to the old beds. In the drawing floor, openings are formed so that the coke can be shot below to be stacked or wheeled away. Movable shoots are provided for directing coke either down below or into the furnace feeding door.

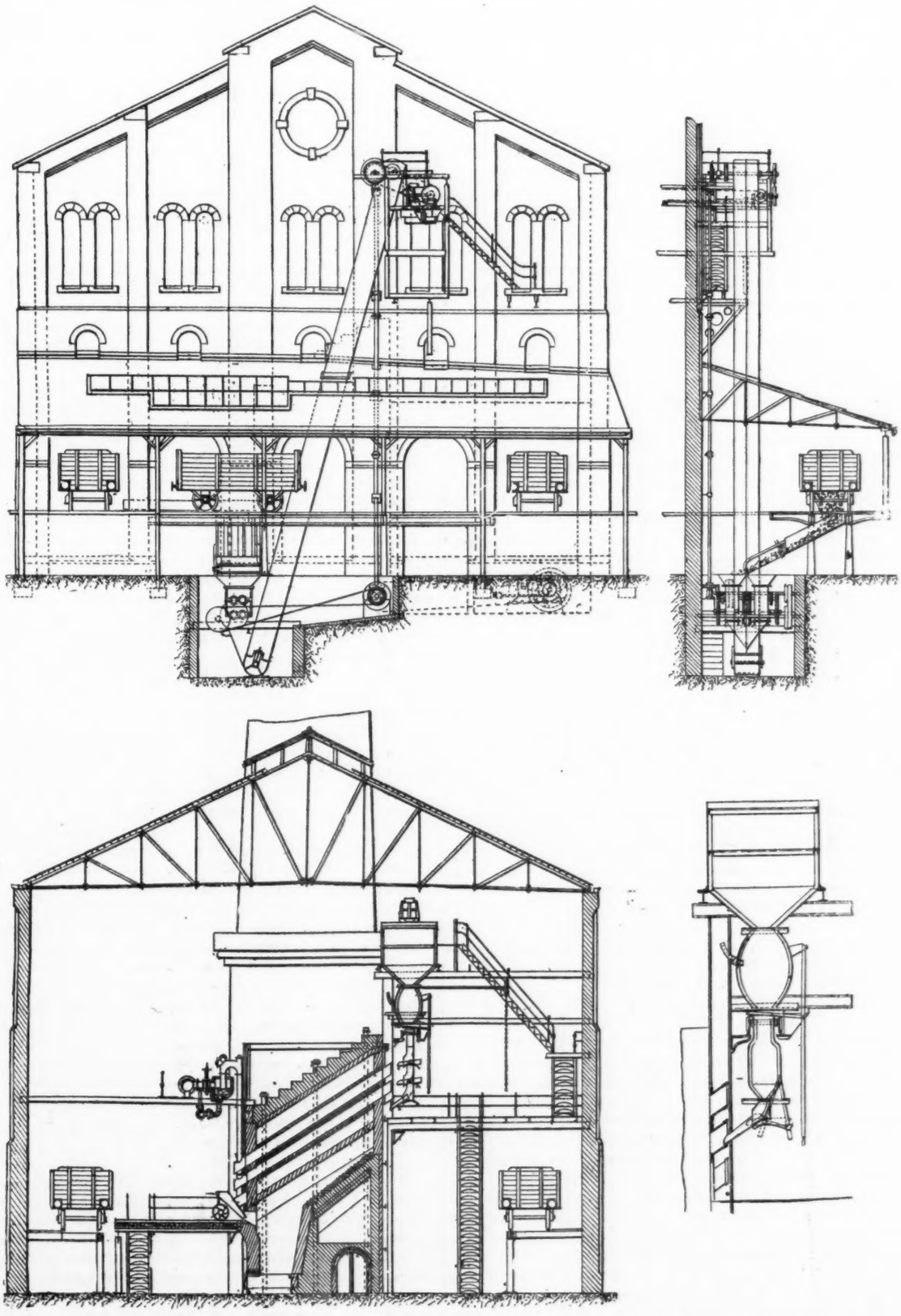
The retorts have mouthpieces on each end fitted up with self-sealing lids on the eccentric screw principle. The gas is taken off from the bottom end; but instead of fixing the hydraulic main in the usual way on the top of the stack, it is carried by girders fixed between the retort bench and retort house wall. This arrangement considerably reduces the length of the ascension pipes; and it enables the hydraulic, foul, and tar mains to be kept clear of the hot bench. A platform is formed along the side of the foul main, reached by a ladder from the drawing floor. The furnaces are well stayed on both sides by vertical and horizontal steel joints, and stays are also fixed across the front and back of the arches; these stays also being used for attaching the top end of the mouthpiece stays. The mouthpiece stays are vertical in both cases, and are much easier to fix than the horizontal stays generally used. They are formed of steel tees and angles, and are well secured both at the top and bottom. Each bed of retorts works into a separate compartment of the hydraulic main, 24 inches by 24 inches, with a flat side to which are attached the saddle branches and handhole covers. Each section of the hydraulic main has an improved saddle, which enables the thick tar to run off; and between the seal-regulating valve and the foul main is fixed a box which separates the tar from the gas, and they are then conveyed in separate mains. A flushing arrangement is provided for each bed, which is simple, yet effective.

There is a continuous coal storage tank the full length of the bench, 7 feet wide by 7 feet 3½ inches deep, with a hopper bottom, and with division plates to each bed. These tanks are capable of holding 90 tons of coal. Each hopper has three measuring chambers, one to each tier of retorts; the slides between being actuated by chain wheels and chains easily worked from the charging floor. The measuring chambers are also supported by girders from the back buckstay to the retort house wall with longitudinal joists to suit; and to the bottom is fixed another set of slides and guides, in this case worked by a lever arrangement. Under the measuring chambers are fixed two lines of rails, on which the movable shoots travel; and these rails are supported on one side by brackets on buckstays, and suspended by brackets fixed to the measuring chamber girders on the other side. Three movable shoots are provided, one to each tier of retorts; and these can be readily moved to the required position, and have a sliding shoot adapted to deliver the coal well into the mouthpiece. There are also two patent movable shoots employed, which do away with the necessity of a measuring chamber, as they combine both in one, and are used in the Dewsbury works for supplying certain retorts with cannel. These are also fixed on the rails and work alongside the other shoots. A platform is constructed alongside the coal storage tanks, and is reached by a staircase from the charging stage; this staircase also having a landing to get to the top gearing of the elevator. Staircases are also fixed from the ground level to both stages. All the platforms and stages are protected by hand rails and standards.

The coal breaking, elevating and conveying plant is driven by a 10-horse power gas engine, which is fixed under the railway at the charging side of the bench. The gearing is arranged outside the retort house, and is driven by a 6 inch belt from the gas engine shaft. The coal breakers are driven by a 5-inch belt from a countershaft, and the elevators and conveyors are driven by means of a 3-inch vertical shaft with suitable bevel-wheel, spur and chain gearing. There are duplicate coal breakers and elevators arranged so that either one can be used at will; and the breaker pit is formed of brickwork with cast iron lining, and is 12 feet square by 12 feet 6 inches deep below the ground floor. The breakers are carried by joists, and are of the heavy pattern type capable of crushing hard coal, and each fitted with four rolls. The whole of the breaker pit is covered in by chequered plates supported by joists, and two hoppers are formed over the breakers, so that the coal when shot down from the trucks feeds direct into the breakers. The latter are arranged so that each can feed into either elevator.

The elevator is duplicated and is fixed outside the gable end of the house supported by a strong framing of joists at the top, and with a platform arranged so that all the working parts can be easily reached. The elevator feeds into a 15 inch push-plate conveyor, which is fixed on the top of the coal hoppers and has suitable slides arranged to fill each hopper. These slides are worked from the platform alongside the coal storage tanks. The coal plant is capable of dealing with 12 tons per hour, and the gearing is arranged so that the machinery can be immediately stopped at several points. The supply of coal is first brought on the gas works sidings by the railway company; then, by means of wire rope haulage, taken to the end of the siding. They are then hauled back and placed in succession over the shoot leading to the coal breakers. All the trucks are weighed in gross as they pass over the weighbridge, and again weighed on returning, after being emptied. The movement of wagons is therefore confined to once going forward and once returning to sidings.

The shoot from the railway siding is placed at an angle of 32°, which enables the coal to be dealt with in the most economical manner. Occasionally we have found that the people at the collieries leave in the coal hard wood wedges, pick heads and other hard substances. A V-stop is put at the delivery end of the shoot, to divide the coal into two streams, as it were, and to enable the youth in charge to have a better chance of discovering in time any foreign substance in the coal. A lever is



fixed contiguous to the place where the youth stands, by which he can instantly stop the machinery in the event of any objectionable substance getting into the crusher hopper. The above arrangement for handling and delivering the coal into the bunkers is, I think, very efficient and very economical. The quantity of gas used by the 10 horse power gas engine has been a little under 30 cubic feet per ton of coal crushed, elevated and deposited into bunkers. This, at our usual selling price for motive power purposes, equals 0.69d. and at cost price about 0.42d. per ton of coal dealt with.

Our contractors both for the building work and for the inclined retort installation used their best efforts to push on the work; but you all know what delays occur in waiting for this, that or the other. Instead of having, as we had hoped, a month to spare before the inclined retorts were actually required, we found ourselves at the last week in

October with every available retort going; and, to add to our difficulty, the weather became hazy, followed by a couple of days' fog. Happily we had had fires going for some time under a couple of the new beds, and at last we started gas making. If anyone, without previous experience, imagines that he is going to start inclined retort work with hands who have never seen these retorts before, and without having trouble of various kinds, he is likely to find himself in error.

The charging shoots were to adjust; and the men employed had to be taught, among other things, that we did not require all the coal delivered at either the top end or at the bottom end of the retort. Our men employed on the old beds took great interest in the proceedings, and frequently expressed an opinion that the fog would beat us. However, we kept "pegging away," and when we had had a little experience, the finish was that we beat the fog instead of the fog beating us. When the men, who were more ready to jeer than to cheer our efforts, saw that the gasholders were rising instead of still further falling, they wisely resolved that, after all, they wished to take their turn on the inclined retorts.

It is, of course, needless to say anything about working regenerative furnaces in lieu of the old direct firing system.

I have mentioned the amount of coke sold by us per ton of coal carbonized under the old style of firing. Under the new system we sold, and got paid for, in the year 1898, 11 cwt. 0 qr. 8 lbs., being 2 cwt. 0 qr. 12 lbs. more per ton of coal carbonized than by the old system. We had a saving on the year's working, in our fuel account, of 2,102 tons of coke, which we sold at an average price of 6s. 10d. per ton. In 1898 we carbonized 19,619 tons of coal, and produced therefrom 211,364,500 cubic feet of gas. Many may consider this a miserable price for good coke (for ours is very good.) Well, you cannot help that when there are coal pits on every hand, and when your home sales only account for 37 per cent. of the total sales. To those who receive from 12s. to 15s. per ton for coke, such a saving as we have affected would be of great importance. And how does this fuel account of ours work out? Well, gentlemen, it works out as follows on the whole year's experience.

Summary of Saving in Coke.

	Cwts.	Qrs.	Lbs.
Coke actually sold in 1898, irrespective of fuel used for boilers supplying steam for engines, sulphate of ammonia plant and unriddled breeze made by using coke forks..... =	11	0	8
Sale when using horizontal retorts..... =	8	3	24
Saving per ton of coal carbonized.....	2	0	12
Total saving, using 19,619 tons of coal..... = 2,102 tons.			

Taking coke production at 65 per cent. per ton of coal carbonized, or 13 cwt. of salable coke, this would give in fuel used in carbonizing coal 13.67 per cent., or 9.64 pounds of coke per 100 pounds of coal carbonized.

Total sales of coke.....	11,024 tons.	
By rail traffic.....	4,766 = 43	per cent.
By boat traffic.....	2,232 = 20	"
By local sales.....	4,026 = 37	"
	11,024	

The average cost of carbonizing wages per ton of coal has been, in 1898, 1s. 3.64d. This cost includes retort house foremen, stokers, coke wheelers and labor on engine and machinery.

In the summer, when only two beds of inclined retorts are in operation and two shifts only worked, the cost went up to 1s. 7.95d. Frequently, on the other hand, when more beds were at work, the cost did not exceed 1s. 1.70d. per ton of coal dealt with. Taking the mean at 1s. 3.64d. per ton, there is a marked saving over the old system previously in use at the Dewsbury gas works. During the winter of 1897–8 we had in work six beds of horizontals (seven retorts in each bed) and four beds of inclined retorts (eight retorts in each bed). The horizontals employed 18 stokers, and the inclined retorts required 9 stokers and 1 engine man. Further, knowing what could be made by the horizontals, we found that the four beds of inclined retorts were producing from 5 to 8 per cent. more gas than the six old beds produced.

The daily production per bed of eight inclined retorts was frequently 130,000 cubic feet. With the full working of the installation of eight beds of inclined retorts, 1 million cubic feet of gas was often exceeded. This is giving what can be done, and was done, when the conditions of dry coal and steady working were obtained. In some larger works, where not less than four beds can be put on at once, a more favorable average cost would be obtained. The heats obtained have been most satisfactory and easily adjusted. That we are utilizing the fuel to advantage is evidenced by our low fuel account and by the appearance of the main flue leading to the chimney shaft.

In order that this paper may not be unduly lengthy, the following points are submitted in paragraphs. As there are probably many who have not had any acquaintance with the working of inclined retorts or regenerative firing, the writer ventures to give them.

In Starting Retorts.—Partly draw the dampers, primary and secondary air slides, put on steam or water supply as required, and increase above when heats want raising. Leave furnace cover off until ready for pushing heats.

Putting Down Retorts.—Leave furnace cover off, let the dampers be partly open, and reduce supply of water or steam to producer furnace. When the bed is cool enough, close dampers, slides, etc.

Temporary Suspension of Work.—Stop firing and nearly close dampers. Keep the requisite quantity of water or steam flowing to prevent fusion of fire-bars. Keep retort mouthpiece lids on discharging floor tightly closed, and retort lids on charging floor very slightly open. When resuming work, adjust dampers and air slides as before.

Everyone will have to find out himself what amount of openings are required in dampers and air slides, as the amount of chimney draught will vary in different gas works; and even beds in the same stack also vary, sometimes very considerably. Have fixed times for the careful inspection of machinery. At the Dewsbury works it is found necessary to flush the outlets from the hydraulic main at least twice a week, which is done with ammoniacal liquor in preference to using fresh water.

At the beginning of working inclined retorts, it was found that our pipes for conveying tar and ammoniacal liquor to the well were too small and had too many bends in the course. We had therefore to lay an 8 inch direct pipe, at a most inconvenient time, and succeeded in reducing the number of angles from seven to one. Since doing this work we have had no trouble in getting away the tar and liquor to the well. If the charge of coal does not arrive at the stop plate, blocked ascension pipes will probably follow. Since adjusting the action of the charging shoots, we have had fewer cases of stopped pipes than we had with the horizontal settings.

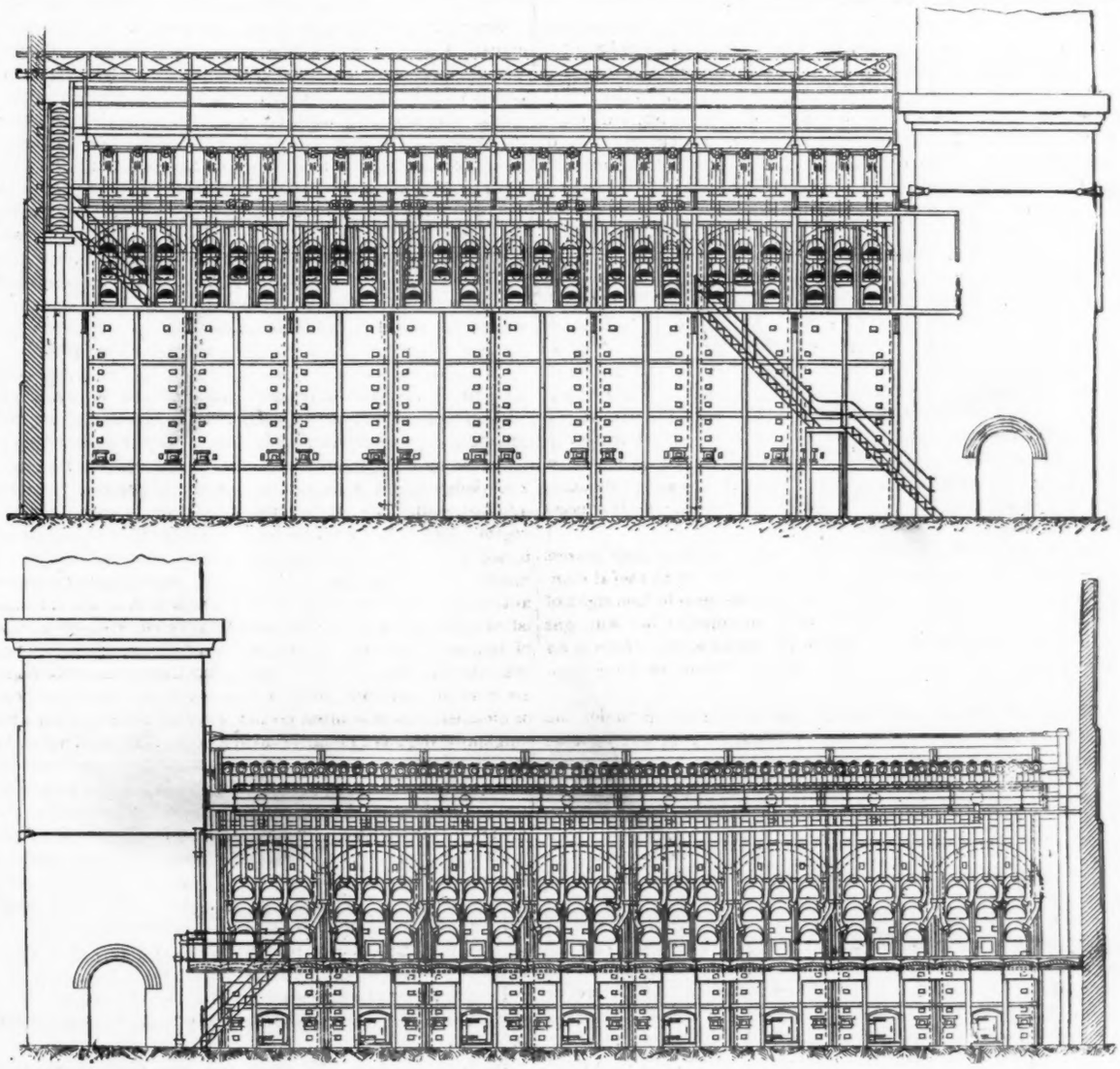
The most reliable men should be placed on the charging floor, and it is well not to change these men from that position. With experience and repeated practice, an intelligent charger becomes acquainted, as it were, with his retorts, and knows which require more or less force in sending down the coal. The faces of mouthpieces and lids are scraped over before being charged, and it has been found advantageous to keep a bucket of common oil in paste and smear the face of the mouthpiece by means of a turk's head brush. This softens the hard tar and reduces blows when the lids are closed.

For greater convenience is pointing the joints, the retorts which are now in three equal sectional lengths, and with the joints at right angles, will in future renewals be as follows: End section joining mouthpiece each 5 feet long and the middle section 10 feet long, and the joints splayed so as to allow them to be built in center of division walls.

The writer is of opinion that the storage capacity of bunkers and measuring chambers combined, should equal one full day's requirements. To prevent the smudge and round coal being unequally divided, it is desirable to have three drop slides at the bottom of the conveyor for each bunker. At the Dewsbury gas works there are three points where levers are placed, any one of which will at once stop the crushers, elevators and conveyors.

(1) Near the gas engine.
(2) Near the crushers, and
(3) At the platform in front of the coal bunkers and conveyors.

It is much more pleasant to speak of successes than it is to detail misfortunes. We have had three breakdowns of our elevators, and it was only on the third occasion that the correct solution of the cause was arrived at. Our duplicated elevators are in a square case made of steel sheets. This casing serves to prevent the waste of the coal dust, and is of the same internal dimensions from top to bottom. It was found that the accidents were caused by pieces of hard cannel projecting over the edge of the buckets, as they began to ascend, and striking against the bottom edge of the casing. The two edges would be ¼ inch apart, and the strain in shearing the projecting pieces snapped one of the links and brought down the whole length of buckets and chain. Of course, these accidents occurred, as most gas works accidents usually do, when the daylight was nearly or altogether spent. Having found out the real cause of the trouble, the outer sheets of the casing were splayed outwards, so as to allow sufficient space for the charged buckets to turn



and ascend freely. This, and the periodical inspections, have proved an efficient remedy for a very trying difficulty. On one of these occasions we had to hurriedly rig up tackling and lift about 30 tons of coal from the railway trucks to the bunkers, before we got the breakdown made good.

Dewsbury is a manufacturing center, and the gas works have only 80 per cent. gasholder storage of the maximum day's make. So you see that it is doubly important in this case to avoid, as far as may be, all chances of a breakdown. As before stated, at the Dewsbury works the building was carried the full height of 50 feet from the ground line. In the opinion of the writer, this is far preferable to sinking the furnaces and coke drop below that line, and then, by some means or other, having to get the coke up again. On the one hand some cost is saved in walling; but, on the other hand, you have the advantage of getting your coke away on the same level as your yard.

I do not claim that the following labor schedule is perfect. My friend Mr. Bower has a very simple way indeed of "manning" his bed —*i. e.*, "one man, one bed of retorts." Still, when you come to work two beds only, the 1 man system of working entails "such a getting up (and down) stairs," that I think our way is, upon the whole, preferable. At least our men preferred our method to the other, and I agreed with their views.

The schedule hereinbefore referred to:

Number of Stokers to be Employed on the Inclined Retorts.

For 2 or 3 beds..	One man on charging floor. Two men on discharging and coke floors.....	Two shifts per day. Men to take last round half hour earlier, and to be allowed to leave work on completion of same.
For 4 beds	One man on charging floor. Two men on discharging and coke floors.....	Three shifts per day. Hourly charges if necessary, when more than 4 beds are at work.
For 5 or 6 beds..	One man on charging floor. Three men on discharging and coke floors.....	
For 7 or 8 beds..	Two men on charging floor. Four men on discharging and coke floors.....	

It is only just to say that we have a good and respectable class of men employed at the Dewsbury Corporation gas works; and to them must be given a portion of praise for the measure of success that we have attained. Had it not been that the work had been pushed on from beginning to finish, we should, in the winter of 1897, have been in a sorry fix. I will close my paper by aga n urging upon those who are putting in inclined retorts to see that they have plenty of time in which to execute the work, and that time is added for the same to dry and consolidate.

The Extension of Gas Companies' Responsibility to Fittings Beyond the Meter.

[A paper read by MR. F. A. WINSTANLEY, of Rotherham, England, at the 36th Annual General Meeting of the Incorporated Gas Institute.]

In introducing this subject for the consideration of members of the Institute, I do not feel that there is much scope for a lengthy paper; but there are a few points which I wish to raise, and which will, I hope, provoke discussion. The question of control of fittings beyond the meter has been too much neglected and deserves the earnest attention of those interested in the welfare and prosperity of the gas industry.

It is to be feared that the supply of gas in the past, with some few notable exceptions, has been conducted upon lines which are too conservative to produce the best results. Gas companies have been too prone to wait, like Micawber, "for something to turn up," in the shape of applications for gas supply—hardly dreaming of pushing the sale of gas before the public, in a similar manner to that followed in other commercial pursuits. In the majority of cases, the employment of these methods means, to the commercial man, success; their neglect, failure. Certainly, in more recent years, we have partially awakened to a sense of our duties and responsibilities, and with the assistance of our friend and opponent, electricity, have shown signs of progression in the right direction, but not nearly to the extent necessary.

In the first place, it would perhaps be as well to consider for a moment for what purpose do gas companies exist? The shareholder's answer might be expected to be "for the making of profit." This, no doubt, is the principal reason from a manufacturer's point of view; but there are others equally important—viz., the supply of their commodity to the entire satisfaction of the purchaser, and the keeping of him fully acquainted with the means of utilizing it to the best advantage. If profit be the only aim and object of a dealer, then, unless he sells the best article he can produce, at a fairly remunerative rate only, and instructs his customers as to the proper use of the same, ill success will certainly result.

Gas companies occupy an onerous position, inasmuch as they possess a monopoly for supplying the public with one of the most useful commodities known. But the tendency in the past has been to lose sight of the duty involved by the possession of such monopoly; for with gas authorities—as in water, electricity and other monopolies—there is an important duty to perform to the public, which should be more generally recognized.

It will be well to consider a few of the defects that exist under the present conditions of gas supply beyond the meter; and here let it be understood that I am considering chiefly the supply of gas through ordinary meters. We are all aware that an improvement has taken place in one direction. I refer to the supply of gas through automatic meters, which system affords the gas company control of the internal fittings. In dealing with supply through ordinary meters, one of the principal defects of the present system is the fitting-up of premises indiscriminately by persons imperfectly trained in the theory and practice of gasfitting work. If one only thinks of the abortions of gas fittings and work seen on every hand, and in almost every house, of the incongruous and ridiculous methods adopted, I venture to say that this part of the subject will appeal to the feelings of every gas manager present. All of us have had almost daily experience of the inconveniences and difficulties caused by the brilliant display of want of knowledge on the part of the "common or garden" plumber, and, indeed, by persons who are proud to call themselves gasfitters, but who have, in reality, only just commenced to learn the merest rudiments of the art. How often do we see old (and even new) houses and premises, fitted—save the word—with ½-inch or ¾ inch lead piping, where it should be 1-inch or more; and this simply thrown, as it were, on to the walls, and even then having more pockets in than a man's suit of clothes. I have in my mind, in dwelling upon this matter, several cases in point, among others being a terrace of twelve houses last rented at from $140 to $160 per annum, containing from eight to ten rooms each, where the internal piping is only ½-inch from the meter outlet, and the fittings are of the commonest description; and yet the tenants of these houses expect to be supplied with gas of the standard illuminating power, and grumble and make the gas manager's lot anything but a happy one, because they cannot understand why their light is poor—arguing that as they are paying 68 cents per 1,000 cubic feet, they ought to have a better light. And from this piping are supplied chandeliers or brackets in every room, and in several cases, gas fires in bedrooms. Is it to be expected that a gas company can satisfy consumers when their fittings are of this description? No doubt the size of the pipe was decided upon by a parsimonious plumber, who had contracted with the builder for the work at a low price, intending to reap his profit by keeping the cost down, to the permanent inconvenience of the consumer, and annoyance to the gas company.

Again, in the fitting up of two gas fires in a certain consumer's residence, no attention whatever was paid by the plumber (the matter being entirely ignored) to the question as to whether the chimneys beneath which the stoves were to be fixed were subject to down draught. The result, of course, was that the gas stoves were condemned as being unhealthy, and creating an abominable stench. Our attention was drawn to the complaint, and the fault remedied, to the delight of the consumer.

One more instance will suffice, although many could be given, and doubtless still many more could be related by my audience, of such cases. A doctor had condemned gas fires, in consequence of his adverse experience in the use of them. His complaint was that the fumes were expelled into the room, thus rendering the atmosphere unwholesome and unhealthy; and he had forbidden the use of them by his patients. He, however, in time happened to meet the gas manager, and thereupon took advantage of the opportunity to condemn gas stoves. But a few questions put by the manager elicited the fact that the stoves were wrongly fixed, and the department undertook to put them right. The fault lay, as usual, with the plumber, who had fixed the stoves *minus* a flue pipe, which fact, of course, explains the reason of the "unwholesome atmosphere." Needless to say, the complaint was cured, and the doctor paid the fee.

Another defect in the present system of gas supply is the lack of periodical examination of fittings. Consider the question of burners. How many gas consumers are there who are possessed of burners calculated to give the best possible results, from both a light-giving and economical point of view? Are not the great majority of consumers attracted by a momentary impulse to buy their burners without any knowledge of the results to be obtained therefrom? This helplessness and ignorance are only what might be expected under the present *régime;* and it is high time that the innocent consumer should be protected and advised by those who are capable of doing so. And, to my mind, the most reliable adviser would be the representative of the gas authority. At present, at the time of purchase, the consumers are satisfied with the recommendations of the seller, and are, in nine cases out of ten, after buying a cheap and nasty class of burner, disappointed with their purchase. Then, assuming that in the first place the burners were the best that could be obtained, how seldom are they examined or cleaned, and how often do the consumers hurl strong epithets at the long-suffering gas company—never for one moment considering whether the blame does not lie at their own doors? Is it not a fact that in every gas manager's experience, that most burners have been so long in use that their age cannot be gauged? And is it not also a fact that every gas manager can relate instances of burners having been in use many years after their efficiency had departed?

I contend that this condition of affairs must, and does, greatly hinder and embarrass the progress of a gas undertaking, and remains a bone of contention as between the gas authority and consumer—thus giving the Englishman full scope for the display of his well known tendency of grumbling unreasonably, without troubling himself to make complaint to the proper authorities.

Further, the employment of unskilled labor makes it very possible for explosions and other accidents to occur, causing danger to life and property.

Now, a word as to cooking stoves. Figuratively speaking, there is "something rotten in the State of Denmark" as regards this department. When one thinks of the needless amount of trouble and inconvenience caused by the various and innumerable sizes, shapes and designations of stoves made by different manufacturers, one is driven to the conclusion that the sooner the whole system is altered and improved upon the better for all concerned. We have, I venture to say, no two stoves made by different makers, and let out by us at the same annual rental, which are alike as regards price, dimensions, and even convenience. The outcome of this is that it is very difficult to fix the quarterly rental in a proper and equitable manner. Neither can we, as in the case of meters and other fittings, adopt standard dimensions and outlets to suit each size of stove, which I think is a matter of great importance. The defects I have pointed out will perhaps be sufficient to show that the conditions existing beyond the meter are not what they should be; there being, indeed, ample room for improvement.

We now have to consider in what way these faults can be remedied; and to commence with I will deal with the internal fitting up of houses, etc., whether it relates to brackets, chandeliers, stoves, or what not. There are several methods which are improvements upon the present system, and which are, in my opinion, essential to the welfare and prosperity of the gas industry generally. In the first place, it should be compulsory for all master plumbers or others undertaking gasfitting work to pass a proper examination, showing their competency to execute such work in an efficient manner. Every master plumber or gasfitter should be responsible for defective workmanship, and should obtain a certificate from the gas engineer before being released from such responsibility—such gas engineer, or his deputy, being obliged, by Act of Parliament, to make the necessary inspection. No doubt this is a new departure, and one which would entail extra expenditure; but I believe that it is one which would well repay the gas company, by rea-

son of the satisfaction given to consumers in their more efficient use of gas.

Another improvement which I would advocate is the systematic inspection of all pipes, fittings, stoves, gas engines and burners by the gas authorities, in order to ascertain the condition thereof, and, when necessary, to advise the consumer as to repairs or renewals. Should it be found necessary after this inspection to overhaul the fittings, etc., the gas authority would find it to their best interest to undertake this class of work, as by doing so they would have personal and intimate knowledge of the manner in which consumers were using the gas, whether economically or otherwise, or whether the supply was sufficient for the purposes of the consumer. I have, of course, in my mind the necessity of charging for such work as this; but I am strongly of opinion that there should be only a very moderate profit made upon the work done or materials supplied.

I have very little doubt that if every gas company or corporation undertook the sale and fixing of all articles required in the use of gas, which are recognized as being of a reliable and useful nature, not only would their revenue increase, but I venture to say that the results would exceed expectation. Therefore, why should those gas authorities who have not already adopted this system (and there are many), delay in doing so when a good dividend or income lies at their door? Perhaps one reason is that many managers are too much controlled by their executive in these matters; but, at the same time, a manager's duties are to advise that executive as to ways and means, and he should leave no stone unturned until his advice (if legitimate) be taken.

In addition to the sale of goods the question of hire and hire-purchase may with advantage be considered. The system of hiring and hire-purchase of gas cookers, heating stoves and fittings should be put into practice. Up to the present the usual method has been to simply hire out stoves, etc.; too little consideration having been given to hire-purchase. There are instances of cases where hire-purchase is practiced, but these are the exceptions rather than the rule.

Each of these systems I have advocated would increase the demand for gas, and add another step towards the success of the undertakings in which we are all so much interested. I will now conclude with a brief summary of the points raised in this paper. They may be classed as follows:

1. Only certified master plumbers or gasfitters to be authorized to do gasfitting work.
2. The periodical inspection of all gasfittings by the gas authorities.
3. The standardizing of cooking stoves.
4. The general adoption by gas companies of the sale and fitting of gas engines, stoves, etc., and the hire and hire-purchase of cookers and other eligible gas appliances; also the hire purchase of gas fires.

It should not be concluded that these suggestions will entail unnecessary expense, and therefore should be shunned on the assumption that the "game is not worth the candle." We shall have a more uphill fight in the future than in the past to hold our position; and it therefore behoves us to use every practicable means in our power to further this object. I am sure if what I suggest were to be carried out, gas undertakings would reap a considerable reward, and secure the goodwill of their clients, which is certainly a "consummation devoutly to be wished."

Coal Dust in Mines.

A writer in *Mines and Minerals* says that by the term dust is meant small particles of solid matter that have surfaces so large in proportion to their contents that they are easily suspended in moving air. Some dust particles are so small that after they have been raised by a relatively slow current of air, they are slow to fall again when the current motion has ceased. There are other dust particles so large that they are lifted only in swift air currents that move with hurricane velocities. Between these extremes the gradations in size are so great in number that their classification has never been attempted.

Coal dusts in common with the dusts of other solids are of various sizes and are found deposited in situations where the current velocity of the air is too low to support them; for example, on the haulage roads in coal mines the large particles that are only suspendable in rapid air currents, such as are set in motion with the swift moving cars, are always found on the floor, while the lesser particles of constantly decreasing size are found at increasing elevations on the projections of the sides, until the top timbers are reached, where on the upper sides are found the impalpable particles that only fall in air that has ceased to move.

In all situations the deposition of dust particles is subject to the common law. "The contents of dust particles are proportional to the velocity of the air movements that suspend them." The largest particles of dust are only suspendable in rapid air currents, and the minutest particles are the only ones that are suspendable in air that has no true current motion, but only an eddy motion, such as is found in a closed room where minute dust particles are seen dancing in a sunbeam.

The gradation of dust particles with reference to the air movements by which they are suspended is especially important with regard to the inflammability of coal dust when suspended in the air of mines. The following propositions are indisputable, and being so, they furnish the facts by which it can be proved that the dust that is suspendable in nearly still air is more dangerous than that which is only suspendable in air currents moving with relatively high velocities. First, large particles of coal can only burn slowly, as the oxygen required for their combustion can only be supplied by converging streams of air that lie in the radii of spheres whose contents are proportional to the contents of the coal particles; this means that a given sphere of air contains the weight of oxygen required for the perfect combustion of a particle of coal.

Some idea of the volume of air required to burn up one of the large particles of dust that are suspendable in a rapid current of air, may be obtained when it is shown that a sphere of air 1.5 inches in diameter is required to supply the necessary oxygen. Experience and observation have shown, however, that such dust is never all consumed, for when it is examined after an explosion has occurred it is found to be coke that has been separated from the volatile matter of the coal.

For particles of dust to be perfectly consumed in a fraction of a second of time by the oxygen contained in spheres of air 1.5 inches in diameter, the velocity of the air converging on the particle of dust would have to be such as cannot be attained, because the necessary motive force is never present to do it.

For coal dust in air to cause an explosion, the heat developed by its almost instantaneous combustion must be sufficient to raise to the temperature of flame the air that contains it. Large particles of dust cannot produce an explosion, because the period required for its complete combustion is too long. Very fine dust, such as is suspendable in nearly still air may, however, cause an explosion, for the following reasons: (*a*) The areas of the surfaces of small particles are much larger in proportion to their contents than those of large particles. (*b*) The disengagement of volatile matter from dust particles is proportional to their surfaces divided by their contents. (*c*) The combustion of the volatile matter disengaged by small particles requires shorter periods than does the volatile matter disengaged by large particles, because the air and the gas are more intimately mixed when ignition occurs.

It may now be safely affirmed that large dust, such as is suspendable in swiftly moving currents of air, is not explosive, and that the only dust that can be consumed in a period of time sufficiently short to raise the air in which it is suspended to the temperature of flame is the fine small dust found in nearly still air. This does not, however, solve the problem of dust explosions, for, admitting that it is only the smallest particles of dust that can supply the combustible requirement of a dust explosion, an important query still remains unanswered, namely: How does the force act that makes the air streams advance on a burning particle of coal dust? The answer is, the air streams within an imaginary sphere do not exist, and, therefore, the force by which the air supply is maintained must be sought for elsewhere.

It has been noticed that the dust found in mines after an explosion consists, wherever the fire has been, of particles of coke that can only have been produced at such a temperature as would be generated by the burning of inflammable matter such as the gases given off by coal, when it is heated.

It is evident from this occurrence, that in such cases it is not the fixed carbon but the volatile matter of the dust that is the cause of the rapid ignition that makes coal dust in air explosive. Again, as no propelling force is present in the air to direct converging streams to the burning dust particles, the means for supplying the required oxygen must be sought for in some other way.

When coal is heated above the temperature of water boiling at 212° F., it gives off inflammable gas, and when the temperature is still further raised, the gas is disengaged with increasing rapidity. Consequently, every particle of dust when heated will project into the surrounding air little jets of gas that will mix with the air and make the required explosive mixture that will, when it is a maximum one,

consist of nine and a half volumes of air and one volume of gas, as truly as any other maximum explosive mixture of gas and air. Granting the accuracy of this conclusion many things that are otherwise inexplicable in the behavior of coal dust when experimented with, become intelligible; for example, the charge of dust in air will sometimes be in sufficient to disengage sufficient gas to make an explosive mixture; and at other times the charge of dust will be so high as to disengage when heated an excess of gas. At other times the dust particles in a swift current will yield gas too slowly.

To illustrate these conclusions, suppose, after the manner of the experiments of Mr. Henry Hall, the English mine inspector, that dust of different sizes is let fall in a mine shaft in which the air has no current motion and that half way down the shaft a large flame is kept burning. Two things would happen; first, the velocities of the falling particles would be somewhat proportional to their sizes and no ignition or explosion would occur until the arrival of some particles that were among the smallest, and were present in just such a charge as would disengage sufficient gas to make a sheet of flame that would fill the shaft when ignition began.

The question here arises, in which portion of a coal mine is the air most likely to be dangerously charged with the class of coal dust that would make an explosive mixture under conditions favorable to its ignition? Such a place is a room in a bituminous mine or a chamber in an anthracite mine. All rooms cannot, however, be equally subject to the dangers of dusty air; for example, the first room on the incoming side of a panel will receive clean, uncharged air, and should a shot blow out at any time no explosion can occur, because the dust normal to the face of the room will have been carried into the room on the return side of it before the shot was fired. The danger of dust charges in the air will, however, increase until the last room on the return side of the panel is reached, for then it is not possible for clean air to enter such a room unless the air has been previously purged.

Dust explosions are generally associated with blown out shots, or air that contains a small percentage of marsh gas. It is also a matter of common experience that coal dust makes a mixture of gas and air explosive that would not otherwise be, but these experiences do not explain why an ordinary lamp flame will not ignite a dust charge that becomes explosive in the presence of a blown out shot. What supplies the efficacy of a blown out shot is not so much its great heating power as its percussive action, for this quickly diffuses the heat and quickens combustion.

In the same way the effects of an explosion of gas are vastly magnified by the presence of coal dust in the air of a mine, for once the air and gas explode, the compression of the air in the neighborhood of the initial explosion intensifies and quickens the combustion of the dust it contains, until the extent of the fiery blast is many times increased.

Where danger from the presence of coal dust lurks in a mine, the air entering a room in which a shot has to be fired should be cleaned by a water spray fixed in the cross cut through which the air enters.

It is possible that very fine coal dust may, without disengaging gas, burn with sufficient rapidity to cause an explosion, as such coal is subject to oxidation, but hitherto very little coal dust has been met with that was sufficiently quick in the diffusion of flame to justify the conclusion.

Construction of Substructures in Streets.

By Mr. Henry C. Hodgkins, C.E.

The proper arrangement of all that is placed under the surface of our streets, such as sewers, water and gas pipes, electrical conduits, etc., is a subject that has received a good deal of attention and thought, and with the increasing devices that are coming into use is forcing itself more and more upon the attention not only of those whose business it is to plan the arrangement, but upon the general public, and especially upon the property owners who are so greatly inconvenienced, and who pay a large portion of the expense, owing to the apparently ruthless way in which the streets are torn to pieces.

The transition from the country road, where the farmer's deed reads to the center of the highway, to the village street and city avenue, where the commissioner of public works and various corporations hold such undoubted sway, has been so gradual, and the uses to which these thoroughfares have been put, both above and below ground, has been so insidiously and continually increasing, that a general view of all these improvements looks more like a tangle of yarn than a systematic arrangement. Yet it must not be inferred that there is any lack of system in all this work. The present condition is the natural result of the gradual development and constantly increasing demand.

In order to thoroughly understand any plan of providing for these substructures, it is necessary to know all the structures which at present find a place under the pavements, and to consider as far as possible those which will probably demand a place in the future.

The first requisite of a good roadway is a thorough drainage of its subsoil. The second is a watertight roof or pavement that will sustain the traffic, and at the same time carry the rainfall to the drains without allowing it to settle into, or be absorbed by, the subsoil. Between these two essentials it is the present practice to place all the structures which we have under consideration.

From providing for the drainage of the soil it has come to be the practice to construct sewers of sufficient size to carry all of the storm waters of the streets, and much of the adjacent property, and, either in the same or separate and smaller sewers, all the household waste. We thus find in every street a sewer varying in size from small vitrified pipe to the large circular or egg-shaped sewers, large enough to drive a horse through, with all the accompaniments of manholes, flush tanks, etc.

Following the construction of sewers, or simultaneously with them, is the laying of water mains. A very trivial matter so far as space is concerned in the first instance, but with the increasing demand, enormous waste, and multiplied uses which rely upon the public water supply, the water mains are increasing in size and number until in some streets a large portion of the subway is occupied by them. Next in order we will mention the gas pipes, generally placed nearer the surface of the street.

One of the very probable things of the future is the supplying of all our fuel in the form of gas, which will place another burden upon our streets. More recently we find in many sections the pipes for steam heating and power. As directly opposite to the steam pipes is the proposition to furnish the condensing medium through pipes to the household refrigerator instead of the now prevailing ice cart. One of the late requirements is the placing in subways of all electric, telephone, telegraph and fire alarm wires. The subways are usually placed just under the pavement. The success of the underground trolley will probably result in all surface lines being finally operated in that way. The ease, comfort and rapidity of this most recent method of transportation are bringing into use larger, heavier and more frequent cars, necessitating tracks as heavy as are required for steam railroads, and foundations unaffected by frost and absolutely against settling. A glance at the construction of these electric roads shows at once how objectionable is the placing of any structure under these tracks which is not of the most permanent character. The space between the tracks and the curbs is generally not more, and frequently less, than half the roadway. The digging up of this narrow space not only jeopardizes the foundations of the railway, but adds greatly to the expense of operating the road and frequently causes great inconvenience to the public, by interrupting the running of cars, to say nothing of the increased cost due to the small space in which to do the work.

All of these structures have frequent hand holes, valve boxes and manholes for access and inspection. All require branch or service pipes to every house on either side of the street. Where the demand for subways will stop is not easy to determine. All of these structures are now imbedded in the subsoil, which must support an unyielding watertight roof or pavement carrying its tons of traffic. The only way to reach all of this subwork, with the exception of the manholes and the large sewers, is by cutting through the pavement. The present method of providing for subwork, so cheap in the first instance, has proven so expensive, inconvenient and unhealthful that some other, even though vastly expensive in the aggregate, is warranted.

It will at once be suggested that provision has been made in all the cases mentioned for generations to come, and that a new plan now means the throwing away of millions already expended. No plan now devised could at once change all the existing improvements, but a plan which would provide space for all alterations, enlargements and new structures would to a great extent avoid the necessity of digging up the streets, and ultimately bring about a condition which would make the tearing up of the streets other than for surface improvements a very rare occurrence.

The plan which has been most frequently suggested is to build a large tunnel under the center of the street, the lower segment of the tunnel to be devoted to carrying sewage. This would necessitate the bottom of the tunnel being constructed on proper gradients, and at proper depths, the portion of the tunnel above the sewage to be occupied by all pipes and conduits now placed under ground, with sufficient space about each to allow for inspection, repairs, enlargements and additions; the portion of the tunnel above the sewer proper to be con-

structed with a larger radius, leaving a shelf or space on each side of the part occupied by the sewer. The sides of the tunnel would have to be pierced for all service pipes, lateral drains, electrical conduits and hydrant branches. This plan presents many difficulties of construction, and in most cases would mean the reconstruction of the greater portion of the sewer system. It would also necessitate the immediate reconstruction of much of the other work that is now in use, as it would have to be beneath all existing structures, or else occupy much of the space now occupied by them. This plan really gives no relief, so far as sewers are concerned, as there would probably be more trouble in keeping the tunnel in repair than is experienced with the sewers as they now exist. There would also be as much trouble with all the laterals as exists under present arrangements. Great difficulty would be experienced in providing means of access sufficiently large and frequent. In many places it would be very difficult, if not impracticable, for the bottom of the tunnel to conform to the grade of the sewer, which would greatly inconvenience the use of the tunnel for other purposes.

Another plan is to utilize the space under the sidewalks. The chief objection to this proposition, and one that would be met at the very outset, is the use now made of this space by the abutting property owners.

Formerly it was conceded that the property owner held the fee to the land to the center of the street, subject only to the right of travel. Courts have held that pipes, wires, etc., under certain conditions, were included in this right; and it has come to pass that the public either as individuals or as corporations, appear to own not only the surface of the street, but as high up as heaven itself, and in some instances as deep down as the other place.

The property owner will perhaps, with justice, cry out against the last and final innovation of his vested rights. He will argue that he has paid for the walk and has paid for the street; that he owns it and should not be disturbed in the peaceable possession of the small portion that is left to him. This is true enough, but special assessments are an iniquitous subterfuge of our statesmen who have drained to exhaustion our exchequer, and should be done away with entirely.

This objection may in some sections be insurmountable.

This space, however, is so suitable and has so much to recommend it that its use is worthy of serious consideration.

These subways should be built with vertical walls, the extra thickness required of those on the street side being obtained by building out under the pavement. In narrow streets where more space is necessary than the width of the walk will afford, the wall could be built farther into the street, and the narrow space of the pavement between the wall and the curb built on a floor supported by heavy girders. Doubtless many compromises would have to be made regarding the space under the walk, and large portions might have to be built partly under the street and partly under the walk. A portion of the space under the walk should always be used so that in all cases access to the subway could be had through the walk and not through the roadway. The walks should be supported by girders, and should be made watertight. Frequent manholes from the walk or from the house side should be provided, and in every block one or two sections of 12 feet feet in length should be so made as to be quickly and easily removed and replaced. Frequent skylights and, where possible, side lights should be provided. Street intersections should be crossed with tunnels of similar proportions.

This plan does not contemplate the changing of large trunk sewers from their present locations in the center of the streets.

In our large cities the large sewers are to a great extent already constructed, and it is very seldom that any occasion for repairs or cleaning necessitates the digging up of the street. The large sewers are easily entered and present all the advantages of examination and cleaning which they could very well have if placed in a subway, which in time would be crowded with other pipes and conduits.

The smaller sewers so far as grades will permit should be the first thing to construct in these subways. They should be built on such grades and proportioned as to size so as to provide for all possible needs of the block, or series of blocks, for which they are planned. As often as necessary these sewers should discharge at street intersections into the main or principal sewer. Where a great depth is required to obtain the proper grade the lower portion should be narrowed to the necessary width to provide only room for the sewer. In most places all sewers of 2 feet in diameter and under could be placed in these subways, sewers of larger diameter being constructed as now in the center of the street.

Above the sewers, and so supported that thorough inspection can be made, should be placed the water mains. These should be placed high enough to leave ample room for house drains to pass under them to the sewer, and they should not be placed directly over the sewer. Above the water pipes and similarly supported should be placed the gas pipes both for fuel and light, steam heating pipes, and all other pipes of a similar nature. Near the top should be placed all electrical conduits, and conduits for telephone, telegraph, fire alarm and all other wires.

At street intersections special manholes for access to the valves should be provided instead of the usual valve boxes now in use. Fire hydrants could be placed as at present, a special drain pipe to the sewer being provided to empty the hydrant after it has been in use.

It is very probable that these subways should not provide sufficient room for the principal conduits bringing the water from its source of its supply, and in a few streets resort would still be necessary to the space under the pavement.

It is not probable nor would it be desirable in changing to this or any other system that present mains or conduits should be disturbed until the opening of the street afforded a convenient opportunity or until occasion for alterations or repairs made it necessary. The very large mains could be retained permanently and connections made with the mains of the subways at street intersections. Mains of two feet or under could all eventually be placed in these subways. Larger mains in the few streets where needed would probably be better placed under the pavement. All service pipes, conduits and house drains would run directly from these subways to the cellar or basement of the houses. All pipes would be readily accessible for making these connections without inconvenience to any one. All pipes, conduits and branches would be easily examined throughout the entire length and the most rigid inspection and care should be used for the prevention of all leaks. Any stoppages in house drains could readily be remedied, as no pipes would be concealed except where they pass through the wall. Ample provision for ventilation should be made by flues attached to adjacent buildings and extending well above them by proper distribution of fresh air inlets.

One objection to this method will be that it duplicates the work by providing for each side of the street, and thereby increases the cost. It does not, however, double the cost, and the duplication of the system has very many advantages. It may also be pointed out that in many streets of our large cities water and gas mains are already duplicated, while the number of electrical conduits would seem to make duplicate systems very desirable. This duplication would permit of smaller pipes being used, which are more easily handled and cared for. The shortening of the service pipes would be no inconsiderable item. It may be said that by using both sides of the street more space is provided than is necessary. This is an excellent fault. If the uses to which our streets are put continue to increase as they have in the past there would be more danger of a lack of space. The ease with which any system could be installed and the greatly increased cost thereof are strong arguments in favor of surplus space.

Take for example the desirability of a separate supply of absolutely potable water. The amount of water used for culinary and drinking purposes is not over 1 per cent. of the total amount of water furnished. Some cities are incurring an expense to purify their water in the cost of construction and maintenance equal to the entire cost of the balance of their system, and even after the best has been accomplished the water is still open to suspicion. Why go to the great expense of purifying 100 gallons of water when 1 gallon is all that is needed? The ease with which new pipes could be placed in these subways and house connections made would make it possible that a supply of water absolutely pure would be obtained. This alone is a very important consideration and the more it is considered the more desirable it becomes.

Many additional purposes will be desirable in the future and any plan designed should provide ample room in excess of present necessities.

This method absolutely relieves the street of all substructures except the large trunk sewers and some of the principal water mains. A tunnel under the center of the street would necessitate the laying of a multitude of branch or service pipes to the side of the street. The difficulties of providing access, light and ventilation to the central tunnel are many times greater.

The provision for the sewers and storm waters greatly increases the difficulties both of construction and maintenance of the central tunnel, and in many instances make the plan impracticable. Many difficulties will be found at street intersections, but they are common to whatever system may be adopted. The sidewalk plan, if the space can be made available, presents many features which make it eminently desirable. Whatever plan is adopted the walls of the subway should have a

smooth, white finish, and the floor should have a hard, smooth finish, with slopes to small catch basins. Every precaution should be taken to keep the subway clean, dry and well ventilated. Most rigid inspection should be made and all leaks prevented. The result would be a great improvement in sanitary conditions and make possible many conveniences and comforts now enjoyed by the few. The cost of the whole subway should be ultimately obtained by rentals for space properly distributed among the various companies and departments making use thereof.

This plan for duplicate mains has been advocated for some smaller towns, but on account of the increased expense has not received serious consideration. The lower cost of iron and the increasing demand for paved streets will lead to more favorable consideration of separate gas, water and other pipes for each side of the street, even in the residential portion of our smaller cities. This plan once adopted it will be but a step to the building of permanent subways as the growth of the city and the importance of the streets demand them. It is at once apparent that walks laid on a masonry foundation will not give trouble from settling. Large sections can be easily removed, thus admitting of new work or repairs on old work with but slight inconvenience.

Smaller cities, by planning their improvements with this end in view, could appropriate this sidewalk space before it is otherwise utilized, and finally escape the expensive conditions experienced by our larger cities.

It has been said that our streets reflect the moral, social and commercial conditions of the community. Certain it is that the more perfect the arrangement, and the more permanent the improvement of our streets, the higher will be the possible attainments of the people in each of these directions.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, July 10, 1899.

The Gas Institute.—Gas Cookers.—The Price of Gas in London.

The 36th annual meeting of the Gas Institute was held in London on the 13th, 14th and 15th ult., under the guidance of the President, Mr. S. Stewart of Greenock, and was a decided success. It may well be quoted in support of the view, which has always found a number of supporters, that the gatherings might be held in London oftener than once in alternate years. The meetings were well attended, and the work was of a steady, solid character, well sustaining the credit of this old Society. The proceedings were marked by one unusual item which deserves mention, as carrying considerable significance to those who have followed the history of the Gas Institute during the last 18 years. That was the entrance into the meeting hall of Mr. Geo. Livesey, Mr. Geo. Bray, and Mr. Sellers, each of whom delivered "a few remarks" from the platform, which were suitably responded to by members of the Institute. This incident will, I think, remain a pleasing memory to Mr. Stewart, on retiring from the seat he so worthily occupied into the rank and file.

The presidential address was exactly what might have been expected from one who, although rarely taking an active part in the proceedings, is known to possess a large and varied experience extending over something like half a century, and to hold broad views on engineering and technical subjects. Mr. Stewart is well abreast of the times, and as active and ready to try new processes or improvements as the youngest member of the Association. His successor in the presidential chair is Mr. E. H. Stevenson, who comes of a good gas family. His brothers occupy important positions in the profession, and his father was President of the Institute about 15 years ago. So Mr. Stevenson is in every way a desirable occupant of that important office, and will efficiently look after the welfare and advancement of the Institute. Eight papers were submitted to the meeting (of which one had to be taken as read), exclusive of a lecture on "Carbureted Water Gas, with reference to the recent Report of the Departmental Commission," by Mr. Arthur G. Glasgow.

The discussions were lively and well maintained, and the credit for this is partly attributable to the subjects and partly to the personality of the readers. The retort house, as is its due, was well in evidence. "Regenerator Firing, "Inclined Retorts," and "The Hydraulic Main" occupied three of the papers. "Carbonic Acid in Its Relation to Lighting and Heating Power," and "Naphthalene Deposits," came in for two more. The remaining subjects pertained to administration and the consumers, and comprised "Differential Rates," Gas for Motor Purposes," and "The Fittings Beyond the Meter." So there was a pleasing admixture of old and new subjects, and the same may be said of the readers. The veteran, Mr. Thos. Newbigging, read his paper and replied to his critics in excellent form, while Mr. W. Carr, Mr. F. G. Dexter and Mr. T. C. Paterson are already known as genuine working members of the Institute. The other gentlemen were newcomers, Mr. F. A. Winstanley, although entrusted with the oversight of a 250 million plant, being one of the youngest gas managers in the Kingdom. The whole of the business arrangements reflected credit on the honorary and the working secretaries, the only matter for regret being the acoustic properties of the meeting hall, which was situated close to a railway station and a playground. In June the windows must necessarily be open, and, judging from the clearness with which railway whistles and boyish shouts resounded through the room, speakers would have stood a better chance of being heard if they had betaken themselves to the railway station or the playground and addressed the meeting from there, rather than ascending the platform. Why is it that acoustics and ventilation are such difficult problems, and in fact appear to be entirely dependable upon chance rather than predetermined design, as shown by the number of specimens of first class architecture that are deficient in one or both respects? Gas engineers must dispose of naphthalene and one or two similar topics, and then see what they can do.

The Council are to be commended for their boldness and tact in tackling a delicate point by advertising a request that representatives of trading firms should not attend the meeting. If this announcement is loyally accepted by the members as an official declaration put forth on their behalf, and as a means of facilitating regular attendance at the proceedings, the objectionable features observable at some previous meetings will be put an end to. Assistance in this direction is afforded by the excellent plan of holding only one sitting per day, viz., from 10 to 2 P.M., which leaves the members a few hours for private business. The matter is one that must depend upon the taste and good judgment of the members themselves. A sweeping exclusion of "traders" would mean a gross injustice to several worthy members of the profession, whose presence is most desirable. And if a representative pushes his wares too loudly, it ought not to be beyond the power of any member to make him clearly understand that his efforts were not appreciated, without being in the least degree offensive. Let it be understood that the members mean to confine themselves strictly to the business of the meeting, and the matter will take care of itself.

The demand for gas cooking stoves has been unusually large this season. One firm tell me that they are crowding all sails and turning out over 1,000 per week, but yet getting behind with their orders. The early summer—for we have already experienced nearly two months of dry, warm weather—may to some extent account for this. But I think the chief reason is that the gas stove has taken a decided step downwards. While its general utility has long been recognized, it has been regarded more as a necessity for the high-class cook, or as a toy for domestically inclined young ladies, than as a rough and ready everyday article. But small shopkeepers and artizans are now waking to the fact that it is a useful and economical utensil in small or busy households, and that the mistress can do her own cooking between the intervals of attending to the shop, or of washing and cleaning up. The action of many companies in supplying stoves in connection with prepayment meters has also served to increase the demand; while the makers are also entitled to considerable credit for their endeavors to put a cheap but at the same time efficient stove on the market. As with other things, while it is not wise to cut prices absurdly low, the mere payment of a high figure does not necessarily secure the most efficient article. There are now some nicely designed though plain single cased cast iron cookers to be had, with griller and simmering burners, that are really good enough for anything. I never could see that raised ornamental designs, hand-painted tiles or polished mouldings were indispensable to the success of a gas stove. The proof of the pudding is in the eating and not in the design of the dish, and similarly the proof of the stove is in the cooking.

A House of Commons Select Committee has been holding several sittings and taking evidence with a view of reporting on the price of gas in London, and especially why the Gas Light and Coke Company charge 3s., while the South Metropolitan Company sell at 2s. 3d. Considerable interest attaches to this inquiry from a technical point of view, by reason of the well known opinions held by Mr. Geo. Livesey, the Chairman of the South Metropolitan Company, who ascribes a considerable portion of the difference to bad management, especially instancing extravagance in capital outlay and an obstinate high-handed policy, both as regards the purchase of coal and the sale of coke, tar products and sulphate of ammonia. Amongst the interesting features of Mr. Livesey's evidence may be mentioned the means by which the

bulk of the new capital issued by his Company was disposed of amongst the consumers of gas, and his explanations of the working of the sliding scale as regards the welfare of the consumers. Mr. Livesey believes that a meter rent is the only fair way of covering the cost of meters, and has a strong objection to anything that tends to increase the cost of gas. He is therefore opposed to the plan of supplping meters free, which really means putting the cost of the meters on to the price of the gas, and charging so much per 1,000 cubic feet instead of so much per meter. Slot meters were introduced in his district in 1892, and on Dec. 31st, 1898, there were over 80,000 in use, in connection with which 63,000 cooking stoves had been fixed. The Company supply everything required, pipes, fittings, stove and meter, at a cost of about £6 7s. 6d. per house, exclusive of service and everything outside. A rent in the form of 9d. extra per 1,000 cubic feet of gas used is charged and goes to pay interest on the capital invested and the cost of repairs and maintenance. The average consumption per slot meter consumer is 16,000 cubic feet, and per ordinary consumer 80,000 cubic feet per annum. The employees of the Company were encouraged to canvass for customers. As regards the difference in the price of gas in various parts of London, Mr. Livesey held that, with different management, the Gas Light and Coke Company could sell as cheaply as the South Metropolitan. Another interesting point dealt with by Mr. Livesey was the question of providing for maximum consumption, in reference to the contention on the part of the Gas Light and Coke Company that they are placed at a great disadvantage by reason of the liability to prolonged fog in their district, which necessitates a larger reserve of plant, from the retort house right up to the consumers' meters, than is usually found to be sufficient. In other words, they claim to be the only Company who have to be prepared to meet a week or ten days continuous fog, which means nearly as much gas being burnt in the day as at night. Mr. Livesey thought that careful working and keeping the gasholders full in readiness for emergency would go a great way towards minimizing this disadvantage.

Mr. J. W. Field, the Secretary and Manager, and Col. Makins, the Chairman of the Gas Light and Coke Company, gave evidence as to the peculiar circumstances which rendered it necessary to charge a higher price than the other London gas companies, and were supported by Mr. Trewby, the chief constructing engineer, and by Mr. Foulger, the chief distributing engineer. Mr. Field said that his Company had kept strictly both to the letter and spirit of the law in the matter of issuing new capital, and therefore did not adopt any special means to induce the consumers to invest. He showed that under the sliding scale the abolition of meter rents was an advantage to the consumer. It was equivalent to three farthings per 1,000 cubic feet of gas, and to that extent hindered the increase of dividend that would follow a reduction of price. While his Company's sales of gas had only increased 98 per cent., the Commercial had gained 116, and the South Metropolitan 218 per cent. in the last 23 years, which was a great advantage, because new capital could be provided more cheaply and laid out in more modern and efficient apparatus. He put in an interesting comparison of the price of gas in 1883 and 1898, respectively, in London and the chief provincial towns.

With regard to slot meters they had over 100,000 customers who were fitted up at an average charge of £8 13s. 8d. per house, which included more substantial and better apparatus throughout, than was provided by the South Metropolitan. The slot meter consumer was charged an additional 9½d. per 1,000 cubic feet of gas. A table also was put in, which showed the sales per mile of main to be about 10,000,000 cubic feet per annum. Another table showed the maximum 24 hours' consumption to be about 1-187th of the annual make in the case of the Gas Light Coke Company, and 1-217th in the case of the South Metropolitan. Mr. Foulger gave some interesting particulars as to the cost of laying mains and services in paved streets. He had wood surfaces to replace in most of the principal streets, which cost ten times as much as granite or asphalt. He also considered that the Gas Light and Coke Company had a much greater proportion of large trunk mains than other companies. Mr. Trewby gave evidence to show that there had been no unnecessary or extravagant outlay in the construction of new and additional works. The inquiry is not yet concluded.

The new Board of Directors of the Louisville (Ky.) Gas Company recently perfected the following organization: President, Mr. Udolpho Snead; Vice-President, Mr. John Stites; Executive Committee, Messrs. Udolpho Snead, John Stites, H. V. Loving, D. X. Murphy and W. J. Abram. A dividend of 2½ per cent. out of the earnings of the past six months was declared.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Something More Regarding "An Anomaly in Incandescent Electric Lighting."

Boston, Mass., July 18, 1899.

To the Editors American Gas Light Journal:

Replying to the question asked by "Gas" in the last issue of the Journal, which had regard to a suggested "Anomaly in Incandescent Electric Lighting," I would say it is without doubt true that, in many cases, it would be cheaper for a user of electric light to buy his own lamps and use lamps of higher efficiency than those provided by the central station. It is the endeavor of the central station manager to provide a lamp that will give the best results for the company, and his point of view is not identical with that of the consumer, although much the same. He must provide a lamp that is efficient and will compete in economy with other methods of lighting, but it must not give out so quickly, either by breaking or by a reduction in candle power, as to become an annoyance to the customer or a source of great expense to the company, the consumer usually paying for the current and the company for the lamps.

If a consumer looks only at the cost, and is willing to put up with the annoyance of frequent renewals, he may save something in some cases by using high efficiency lamps, this being more often true where the regulation is very good and where the customer pays for the lamps.

The value of an incandescent lamp to a user of electric light depends upon the number of candle hours it will produce during its usual life (which is usually considered to have ended when it will give only 80 per cent. of its initial candle power) combined with the average efficiency at which the light is produced. As is well known the candle power and efficiency do not remain constant, but continually decrease while the lamp remains in service. The higher the initial efficiency (or the higher the heat of the filament) the more rapid the deterioration, as shown by the table herewith, which is based on Edison standard 3.1 watt lamps:

Normal Voltage.	Life Factor.
100 per cent.....	1.000
101 "	0.818
102 "	0.681
103 "	0.562
104 "	0.452
105 "	0.374
106 "	0.310

It is generally accepted by central station managers that lamps consuming 3 watts per candle power are as efficient as can be commercially successful, even with good pressure regulations. Some stations supply lamps of 3½ watts efficiency, but these are places where the conditions are not favorable to the best regulation.

We will take the case of a customer using 3.1 watt, 16-candle power lamps provided by the station without charge and see if it would be possible for him to save, using current at 20 cents per 1,000 watt hours.

Assuming the *useful life* of a lamp to be 350 hours with good regulation, it would produce, approximately, 5,500 candle hours and consume 17,360 watt hours at a cost, to the customer, of 63 cents per 1,000 candle hours for current. If the customer substituted at his own expense 2.54 watt lamps of 16-candle power, each would produce about 1,500 candle hours in a life of 108½ hours, consuming 4,409 watt hours at a cost of 59 cents per 1,000 candle hours for current and 13 cents for lamp, a net loss to him of 9 cents. The candle hours above given are not the results of multiplying the hours by the candle power, but are the averages of a number of tests. Could he get the company to furnish such lamps free he would save 4 cents. Were he willing to get poorer distribution he could buy 24-candle power lamps at the same price as 16-candle power, and make the cost per 1,000 candle hours 59 cents for current and 8.7 cents for lamp, a total of 67.7 cents, or a loss of 4.7 cents per 1,000 candle hours.

Were a customer using 3½ watt lamps, either supplied by the station or purchased by himself, he could save, provided the regulation was sufficiently good, by using lamps of higher efficiency, say 3.1 or 3 watts per candle power, as can be readily figured; but it would be much simpler for him to order his lamps of the candle power and efficiency per candle power desired, for the voltage at which they were to be operated, rather than to order them for a lower candle power, efficiency and voltage than desired, and increase all himself.

The table given in the question evidently gives the life of a lamp as the length of time it will give *some* light, not its useful life, and is, therefore, somewhat misleading. Respectfully yours, Electric.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. W. A. BAEHR has been appointed Superintendent of the gas division of the properties of the Denver (Col.) Gas and Electric Company.

ON the petition of five creditors, whose claims amounted to less than $1,000, the Lexington (Mass.) Gas Light Company has been adjudged bankrupt.

MR. WILLIAM OLIVER, of Waterloo, has been appointed Superintendent of the Seneca Falls and Waterloo (N. Y.) Gas Light Company, vice Mr. Robert J. Dobson, resigned. The Directors authorized the President to "remember in a substantial manner the past services to the Company" of ex-Superintendent Dobson.

AT the annual meeting of the Milford (Mass.) Gas Light Company the following Directors were elected: Joseph B. Bancroft, G. A. Draper, F. J. Dutcher, C. F. Claflin, B. E. Harris, E. L. Wires, N. B. Johnson, J. E. Walker, L. H. Cook and I. N. Davis. Subsequently the Board was organized by the naming of the following officers: President, Joseph B. Bancroft; Treasurer, B. E. Harris; Secretary, H. C. Tilden—Mr. L. H. Cook, who had served the Company as Secretary for 29 years, declined a re-election. The Company improved its position considerably during the year.

THE Council of South Bend, Ind., has revoked the franchise for the operation of an opposition gas plant there, granted some time ago to Hugh H. Hosford and associates, on the ground that they had failed to commence the work of construction within the time limit named.

MR. J. B. CAHOON has resigned the position of General Manager of the Elmira (N. Y.) Gas and Illuminating Company, to assume the duties of Manager of the Syracuse (N. Y.) Underground Electrical Wiring Company.

MR. EDWARD A. RICHARDS, "of New York," has abandoned the idea of going in for an opposition gas works in Savannah, Ga. In stepping down and moving out he remarks, "After a three months' canvass of the city, and a full investigation of the situation, I regret to say that I am compelled to relinquish the plan of the establishment of another gas plant here, for two reasons. The first is that the high price of coal and labor precludes the possibility of any profit to the new company at $1 per 1,000, unless a much larger consumption of gas than is now used in Savannah could be secured. The other reason is that I have been unable to secure the requisite number of contracts to justify my friends going into the business."

AT a recent meeting of the Borough Council of Leonia, N. J., Mr. W. C. Thomas, of the Hackensack Gas and Electric Light Company, asked for the adoption of a resolution granting the Company permission to lay pipes to distribute gas to the residents of the Borough. He offered to register a bond in sufficient sum that the streets would be restored to their normal condition when the pipes had been laid, and that the rate charged would not exceed that charged in Hackensack and Englewood. The Board without dissenting voice assented to the petition.

MR. A. M. MASON, formerly Superintendent of the St. Albans (Vt.) Gas Light Company, has been appointed to a responsible position in the service of the Fall River (Mass.) Gas Works Company.

MR. CHARLES E. DOLLEY has been appointed Treasurer of the Malden and Melrose (Mass.) Gas Company, vice Mr. V. W. Mason, resigned.

THE new gas plant of Athens and Sayre, Pa., will be completed and in working order by October 1st.

THE proprietors of the Athens and Sayre (Pa.) Gas Company have agreed to put the selling rates at these figures: When used for both cooking and lighting, $1.25 per 1,000; when used for lighting or cooking alone, $1.50. The Company agrees to furnish gas ranges to responsible parties free of charge. The Waverly and South Waverly (N.Y.) gas plants are now in complete possession of the owners of the Athens and Sayre Company.

THE plant of the Stevens Point (Wis.) Lighting Company has been purchased by the syndicate that is controlled by Mr. William Mainland, of Oshkosh, Wis.

MENTION of Mr. Mainland and Oshkosh recalls the fact that the net selling rates at Oshkosh, beginning August 1st, will be: On illuminating account, $1.50 per 1,000 cubic feet; for fuel and power use, $1 per 1,000.

"A. V. B." is informed that the annual meeting of the shareholders in the Equitable Illuminating Gas Light Company, of Philadelphia, will be held at 11 A.M. of the 7th prox., in the Company's office, northwest corner Broad and Arch street, Philadelphia, Pa.

THE following circular was issued to the residents of Warren, Ohio, by the Warren Gas Light Company, under date of the 10th inst.: "Cheaper gas" is the announcement the Warren Gas Light Company makes to the consumers for the fifth time in 16 years, during which time the price has been reduced gradually from $2.50 per 1,000 to the present low prices. From July 1st, 1899, the prices for gas will be as follows, depending upon the amount consumed per month through one meter:

Monthly Consumption.	Price per 1,000.
Less than 20,000 cu. ft.	$1.10
20,000 cu. ft. to 60,000 cu. ft.	1.00
60,000 cu. ft. to 100,000 cu. ft.	.90
100,000 cu. ft. and over	.80

These prices practically make a reduction of 25 cents per 1,000 from former net prices. Instead of making a gross price and a net price, with a discount from the gross price for prompt payment, as heretofore, the Company names the lowest possible cash price, and will insist upon prompt payment of bills. The prices named are very low for gas of the quality furnished, and in a city the size of Warren, and the Company hopes and expects that the consumption of gas throughout the city will be increased to an extent that will justify it in making these very low prices. In these days gas stoves are regarded as necessities and not as luxuries; great improvements have been made in them and now they do better work than ever before. There are many first class stoves and ranges made. You can find them at the office of the Gas Company and other places in Warren.

IN this announcement the continued good business discernment of Mr. George H. Tayler is shown, and its sequel is the surety that "strikers" will keep away from the district which his Company so faithfully serves.

THE fire that recently destroyed a portion of the plant of the Riter-Conley Manufacturing Company, of Pittsburg, Pa., will in no way interfere with the Company's ability to carry on to completion its contracts.

THE Santa Monica (Cal.) Electric and Power Company has placed an order with the Western Gas Construction Company, of Fort Wayne, Ind., for a complete gas plant. The order calls for an improved Lowe, double superheater, water gas apparatus, up to a capacity of 100,000 cubic feet per day, together with purifiers, a 30,000 cubic feet storage holder, station meter, street main governor and connections, and general connections throughout the works. The plans provide for as complete and modern a gas plant as it is possible to construct.

MESSRS. W. V. COONS and J. M. Barr, of Findlay, O., have purchased the plant and properties of the Defiance Light and Railway Company at public sale under court orders. The price paid was $16,331. If this report is true, and we have sensible reasons for believing it, Coons and Barr have secured a decided bargain.

MR. CHARLES T. WILLIAMSON, for many years in the employment of the old Pittsburg (Pa.) Gas Company as a meter repairer, died at his home in State Lick, Pa., on the 7th inst. He was widely and well known amongst the meter makers of the United States. Deceased was in his 73d year.

THE Northampton (Mass.) Gas Company has determined to extend its mains to the outlying district of Florence, a move that should have been made long ago.

THE Citizens Gas and Fuel Company, of Terre Haute, Ind., is arranging to construct a plant for the working up of its tar into various merchantable products.

THE Napa (Cal.) Gas and Electric Company has filed articles of incorporation, and its capital is put at $100,000. The Directors are Messrs. Thos. Addison, S. E. Kearney, O. E. Clark, John L. Howard and J. G. Whittington. The Company was organized for the purpose

of taking over for consolidation the properties of the gas and electric lighting companies of Napa City.

THE proprietors of the Poughkeepsie (N. Y.) Gas Light Company have the satisfaction of knowing that all the claims of damage that arose through or by the unfortunate explosion which occurred in the plant last December, have been amicably and fairly settled, without an appeal to the courts.

THE franchise granted to the Peoples Gas Company, of Denver, Col., has lapsed, through the failure of its promoters "to deposit $25,000 as a guarantee of good faith" on or before the 10th inst.

MR. A. M. PAFF has been elected President of the proposed gas company for Bangor, Pa. Its Secretary and Treasurer is Mr. Oliver Labar.

WE understand that the City Gas Company, of Norfolk, Va., has again changed hands. Its present owner is said to be a syndicate, of which R. Lancaster Williams is the nominal head. As the party named is also supposed to control the fortunes of the Virginia Electric Company, a fair presumption is that hereafter there will be entire harmony in the matter of supplying gas and electric currents to the residents of Norfolk; at least so far as the suppliers thereof are concerned.

THE Essex and Hudson Gas Company, of Newark, N. J., is constructing an important addition to its purifying plant at the South Market street station.

THE Consolidated Gas Company of Pittsburg, Pa., has declared a semi-annual dividend of 3 per cent. on its preferred stock, payable the 1st prox.

THE franchise for a gas works at Rossland, B. C., has been granted to the Toronto, Can., syndicate, which is controlled by the Messrs. Pearson and associates, of the latter named city.

A CORRESPONDENT in Sacramento, Cal., incloses the following: "Early this month Judge Johnson, of the Superior Court, rendered a decision in favor of the Capital Gas Company, of Sacramento, in the suit brought against the Company for damages, alleged to have been sustained by one William M. Smith, through the Company having removed its meters from his furnishing goods establishment. The decision, which treats of the circumstances, defines the law and gives judgment against Smith, runs about as follows: 'The plaintiff brings this action against the defendant, a gas corporation engaged in supplying the inhabitants of the city of Sacramento with artificial light, etc., under the provision of Section 629, C. C. That section reads as follows: Upon the application in writing of the owner or occupant of any dwelling or premises distant not more than 100 feet from any main of the corporation, and payment by the applicant of all money due from him, the corporation must supply gas as required for such building or premises, and cannot refuse on the ground of any indebtedness of any former owner or occupant thereof, unless the applicant has undertaken to pay the same. If, for the space of 10 days after such application, the corporation refuses or neglects to supply the gas required, it must pay to the applicant the sum of $50 as liquidated damages, and $5 a day as liquidated damages for every day such refusal or neglect continues thereafter." 'The plaintiff is a merchant engaged in the conduct of his business at 424 and 426 J street, in the city of Sacramento. His business is conducted in two distinct buildings, but connected by an open way between the two, in one of which he conducts a hat store and in the other a gentlemen's furnishing store. From 1887, down to within about two years before the commencement of this action, he had been using the gas of defendant exclusively for lighting purposes. About two years before this suit was commenced he introduced electricity into his stores, and from that on ceased to use defendant's gas in any appreciable quantity. It was in evidence that the amount consumed by him for the year just prior to September 11, 1898, amounted to $1 in the one store and 75 cents in the other. At that time the defendant, against the wishes of the plaintiff, removed the meters from both of the stores. A few days after the removal plaintiff gave the defendant written notice, as required in Section 629, just cited, to provide him with gas in each of his premises. The defendant refused to replace the meters unless he would assure it that he would consume at least 50 cents a month worth of gas, or pay a meter rent of 50 cents per month. Plaintiff declined to give such assurance, and defendant refused to furnish the gas. Plaintiff brings this action for the penalty of $5 in each instance, and for damages at the rate of $5 per day in each case, from the time of the refusal. We are met at the very threshhold of this case with the question whether Section 629 is constitutional. That section was a part of the original Codes, as first adopted by our Legislature, and has ever since remained intact. At the time of its adoption individual persons could not obtain a franchise to supply gas to the inhabitants of towns and cities. The Constitution of 1879, Article II., Section 19, changed this rule, and provided that when the municipality does not own the works for supplying it with artificial light, any individual, or any incorporated company, under certain restrictions, may engage in such business, and may do the things necessary thereto, such as laying down pipes in the public streets, etc. It will be seen, then, that when Section 629 was enacted, only companies could engage in such work, but that the Constitution of 1879 changed that and permitted individuals, as well as corporations, to engage in such matters; that, while the fundamental law has been changed, the Legislature has not amended its laws—that is, Section 629—so as to make it conform to the Constitutional requirements. The objection is that Section 629 imposes a severe penalty upon a corporation engaged in supplying gas, while it imposes no such penalty upon the individual who is likewise supplying gas, thereby making an unjust discrimination between natural and artificial persons. Our Constitution provides that no special privileges or immunities shall ever be granted, and that no citizen or class of citizens shall be granted privileges which, upon the same terms, shall not be granted to all classes of citizens (Article I., Section 21). I imply from this that it is intended that all persons in the same category are to bear the burdens equally, and not that one person is to bear a burden and another be excepted therefrom. The rights of every individual must stand or fall by the same rule or law that governs every other member of the body politic, or land, under similar circumstances; and every partial or private law, which directly proposes to destroy or affect individual rights, or does the same thing by affording remedies leading to similar consequences, is unconstitutional and void. Were it otherwise, odious individuals and corporate bodies would be governed by one law; the mass of the community, and those who made the law, by another; whereas, a like general law, affecting the whole community equally, could not have been passed." (Wallys Heils vs. Kennedy, 24 Am. Dec., 511; Vanzant vs. Waddel, 2 Yerger, 260; Cooley's Constitutional Limitations, 479 et seq.) Special burdens cannot be laid upon a particular class in the community. (Millet vs. People, 117 Ill., 294). I do not know how the principle involved could be more forcibly put than it is in the citation just named. The inequality of the burden placed upon a corporation by Section 629 is apparent and plain to all. To say that a corporation engaged in a particular business shall, upon failure to do a certain act, be mulcted in heavy damages, and to say to the individual engaged in the same business, perhaps along side with it, shall go unmolested for the same offense, is repugnant to all feelings of fairness, and is giving special privileges and immunities to one that are not given to the other. By the 14th amendment of the Federal Constitution it is provided that no State shall deprive any person of property without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws. The Supreme Court of the United States has repeatedly held that corporations are persons within the meaning of this amendment. (Smythe vs. Ames, 169 U. S. 522; Santa Clara County vs. Southern Pacific Railroad Company, 118 U. S. 394; Blake vs. McClung, 172 U. S. 259.) It would seem that that ought to dispose of this case, even if the section were not repugnant to our own State organic laws. The 14th amendment says a State must not deny to any person within its jurisdiction the equal protection of the laws. A law that says one person may be assessed in heavy damages and another not—though they do the same act—is not affording equal protection. The Supreme Court of the United States says a corporation is a person; therefore, to say that a corporation shall be held liable for an act and an individual not, for the same act, does not afford equal protection to the two persons, and is repugnant to the provisions of the 14th amendment. It has been urged that a corporation is the creature of the law, and that it has no right to exist except upon such terms and conditions as the law permits. It seems to me that this is answered by the fact that while the corporation exists under such terms and conditions as the law permits, the law does not permit a discriminating rule to be enacted, and all such attempts are futile and void, and such is the fact in reference to Section 629, C. C. Until that section is amended so as to make it apply to all persons alike, whether natural or artificial, its provisions cannot be enforced against an artificial person—that is, a corporation. Having come to this conclusion, it is unnecessary to discuss the many other important questions which arose at the trial of the case. Let judgment be for the defendant."

The Market for Gas Securities.

The decline in values of New York city gas shares continued during the week. Consolidated sold yesterday (Thursday) at 172½, but a sharp recovery brought the price back to 176 and over before the day's trading was done. To day sales were made at 178½, and there was every indication that the low point for the present had been reached. On the surface there is no particular change in the situation, and canvassing is not being carried on with marked vigor. The news tickers and news sheets have been abundantly supplied with bear talk regarding Consolidated, but our advice is not to go short of it. Amsterdam common is 31½ to 32, and weakness is also shown in the Standard securities.

Brooklyn Union is dull and lower, and the same statement goes in respect of Bay State, which is easily purchasable at 2. Peoples, of Chicago, holds its own, and the Laclede issues are in good demand. Buffalo gas is very weak, being 8½ bid, 9½ asked. The general situation is favorable to the investor.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 Wall Street, New York City.

July 24.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	177½	178
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	260	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.	13,000,000	100	31½	32
Preferred	10,000,000	100	58	59
Bonds, 5's	11,000,000	1,000	100½	101
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	112	..
Preferred	5,000,000	100	135	138
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	139½	143
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1⅞	2
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	40	..
" 1st Mtg. 5's	450,000	1,000	95	98
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	8¾	9⅛
" " Bonds, 5's	5,250,000	1,000	84	85
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	106	108
Consumers. Jersey City	2,000,000	100	95	.
" Bonds	600,000	1,000	107½	110
Cincinnati G. & C. Co.	8,500,000	100	180	182
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	61½	62
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	880,000	1,000	87	90
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	65	65½
" Prior Lien 5's	4,546,000	1,000	94¼	94½
Detroit Gas Co., 5's	423,000	1,000	95½	96
" Inc. 5's	31,000	100	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	77	83
" Bonds	2,000,000	..	80	85
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co.	250,000	50	50	..
" 1st Mtg. 5's	250,000	1,000	96	100
Jersey City	750,000	20	225	275
Lafayette Gas Co., Ind.	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86
Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	54	54¼
Preferred	2,500,000	100	98	100
Bonds	10,000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	82	85
" 1st Mtg. 6's	350,000	1,000	102	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53½	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	117½	117¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	111½	112
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	215	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	70	73
St. Paul Gas Light Co.	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	80	82
St. Joseph Gas Co.	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96	99
Syracuse, N. Y.	1,750,000	100	16	19
Bonds	1,612 000	1,000	81	84
Washington, D. C	2,000,000	20	260	265
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	99	100
Bonds, 5's	3,830,500	.	106	108
Wilmington, Del.	600,000		214	..

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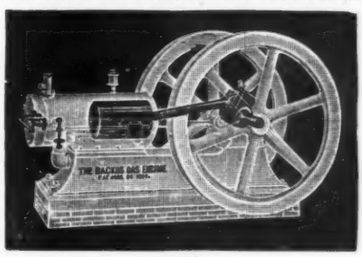

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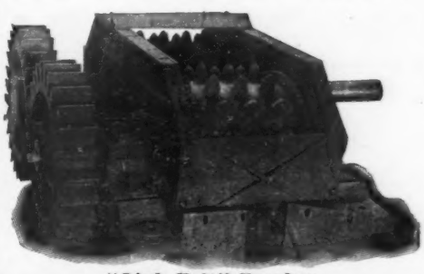

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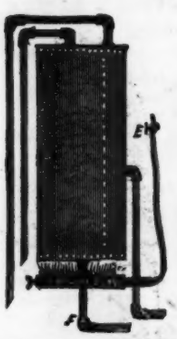

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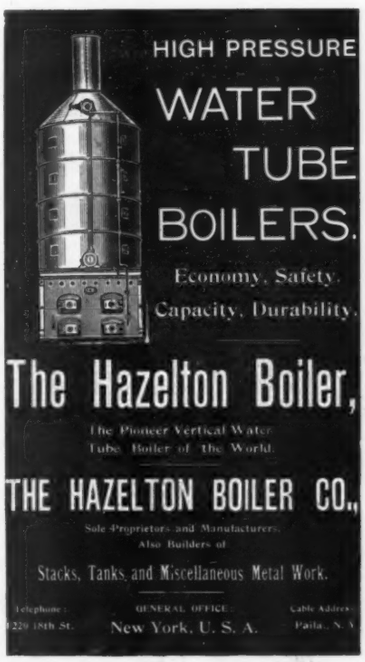
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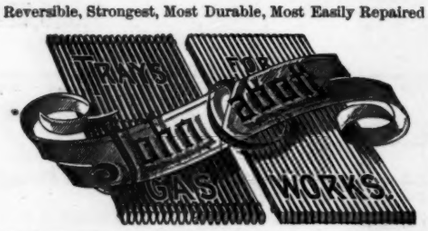

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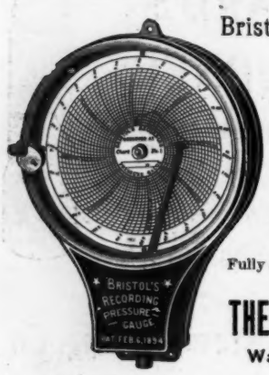

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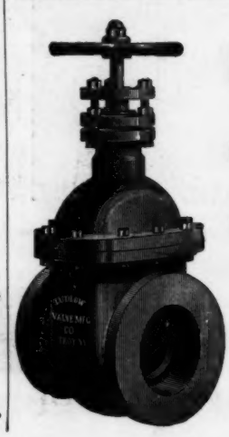

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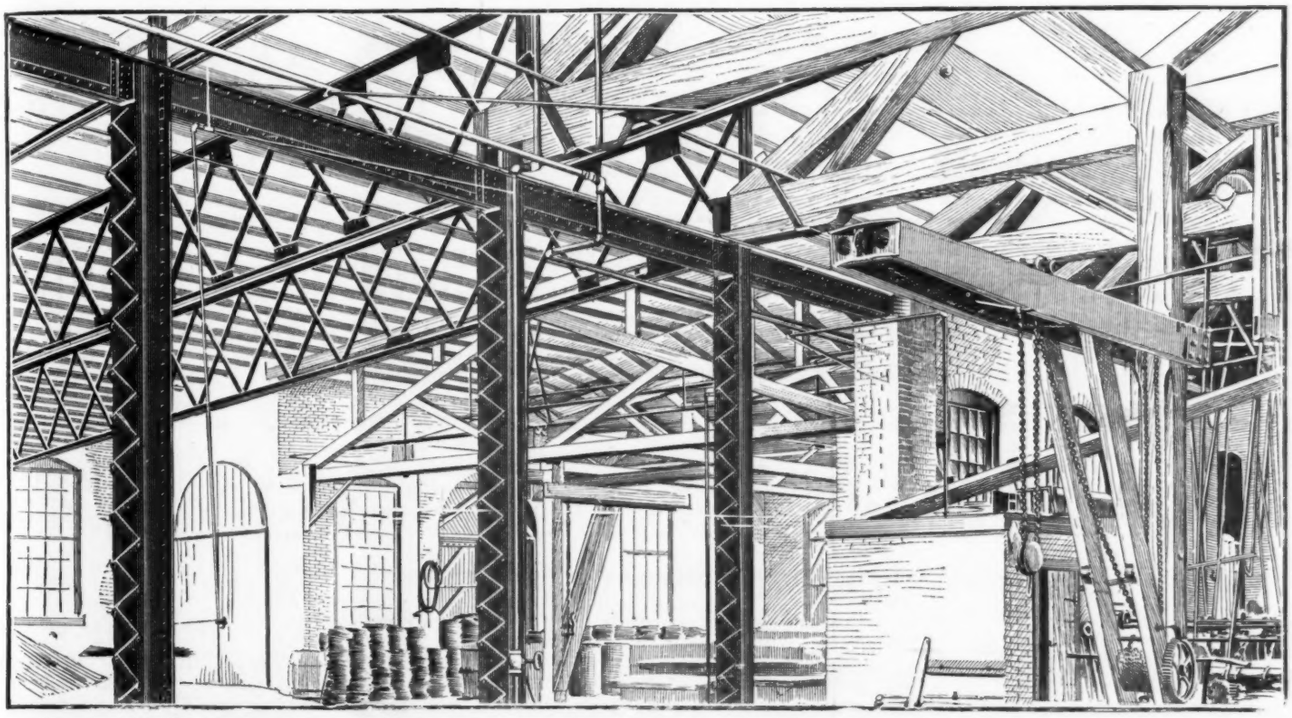

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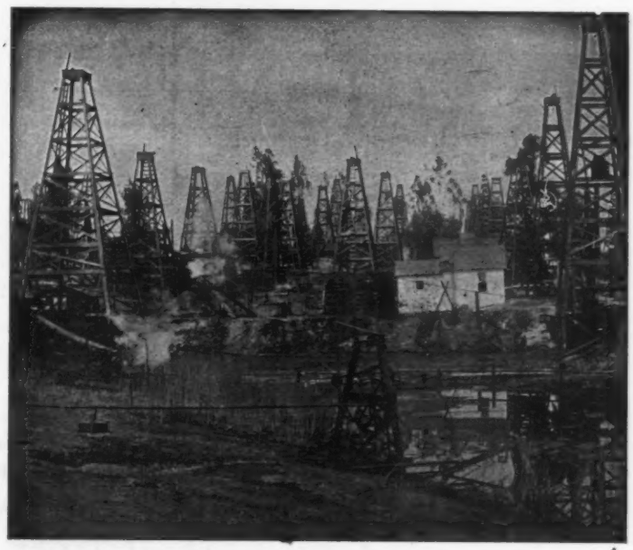

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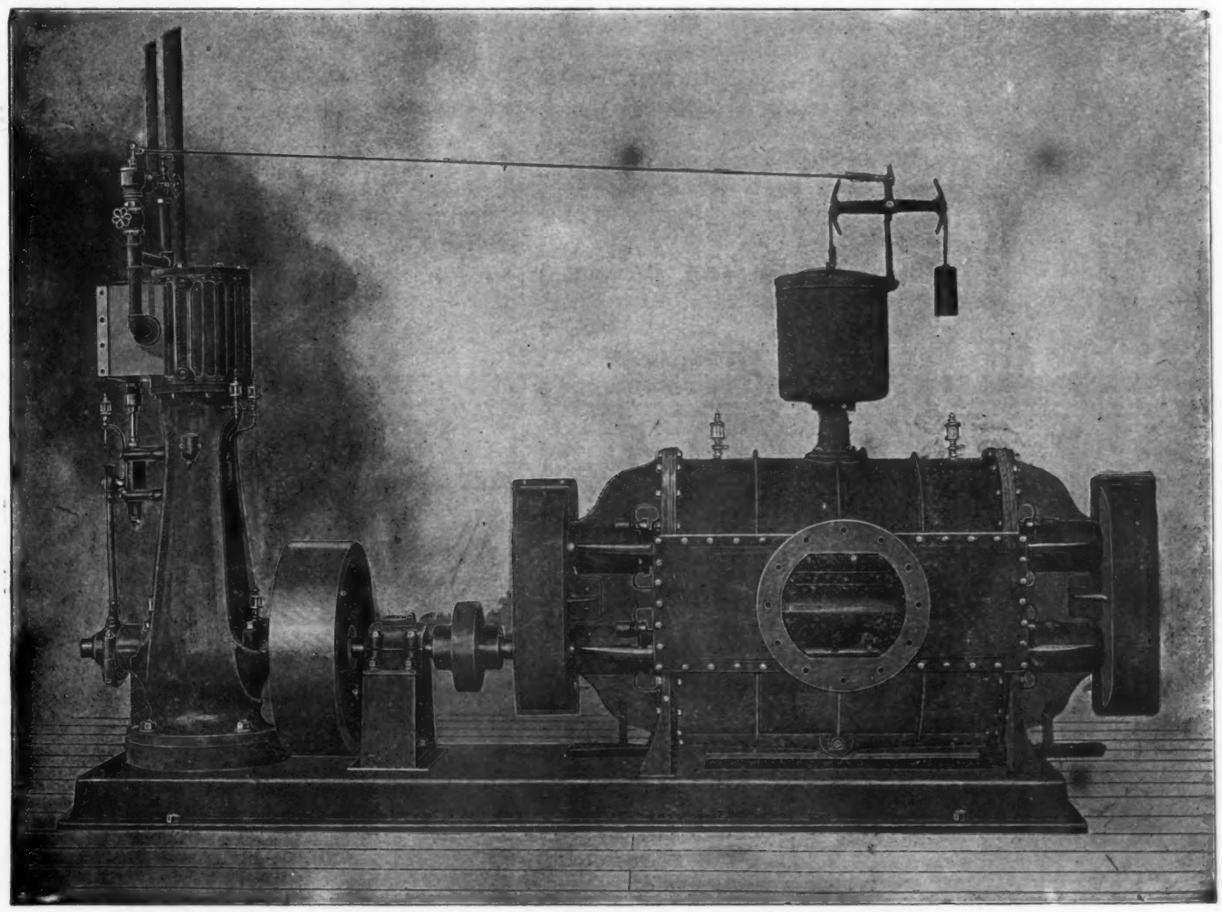

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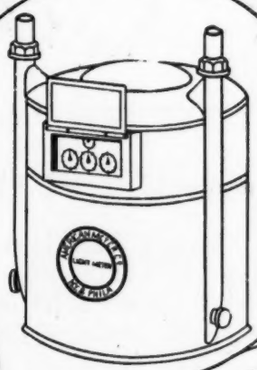
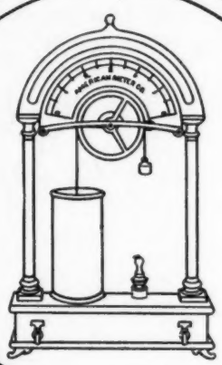
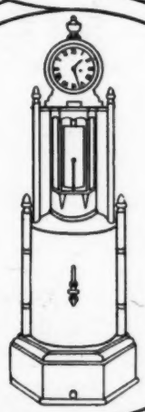
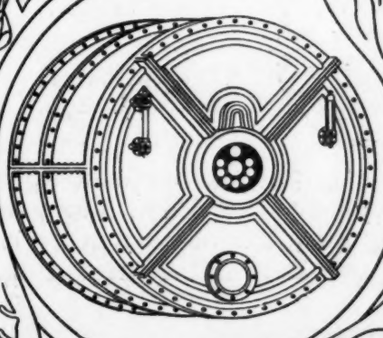








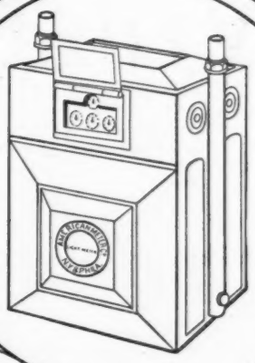
PUBLIC LIGHTING TABLE.

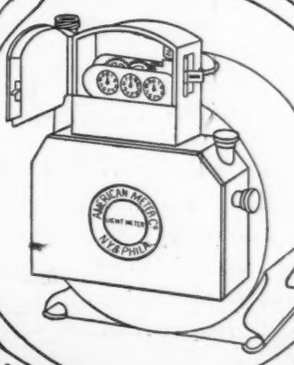
AUGUST, 1899.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	7.40 PM	2.20 AM	7.10	3.30
Wed.	2	7.40	4.00	7.10	3.30
Thu.	3	7.40	4.00	7.10	3.30
Fri.	4	7.40	4.00	7.10	3.30
Sat.	5	7.40 NM	4.00	7.10	3.30
Sun.	6	7.30	4.10	7.10	3.45
Mon.	7	7.30	4.10	7.10	3.45
Tue.	8	7.30	4.10	7.10	3.45
Wed.	9	7.30	4.10	7.10	3.45
Thu.	10	7.40	4.10	7.10	3.45
Fri.	11	8.10	4.10	7.10	3.45
Sat.	12	8 30	4.10	7.10	3.45
Sun.	13	9.10 FQ	4.10	6.55	4.00
Mon.	14	9.50	4.10	6.55	4.00
Tue.	15	10.50	4.10	6.55	4.00
Wed.	16	11.50	4.10	6.55	4.00
Thu.	17	1.00 AM	4.10	6.55	4.00
Fri.	18	2.40	4.10	6.55	4.00
Sat.	19	No L.	No L.	6.55	4.00
Sun.	20	No L. FM	No L.	6.45	4.10
Mon.	21	No L.	No L.	6.45	4.10
Tue.	22	7.10 PM	8.20 PM	6 45	4.10
Wed.	23	7.10	8.50	6.45	4.10
Thu.	24	7.10	9.30	6.45	4.10
Fri.	25	7.10	10.00	6.45	4.10
Sat.	26	7.10	10.40	6.45	4.10
Sun.	27	7.10 LQ	11.30	6.30	4.20
Mon.	28	7.10	12 20 AM	6.30	4.20
Tue.	29	7.10	1.10	6.30	4.20
Wed.	30	7.10	2.10	6.30	4.20
Thu.	31	7.10	3.10	6.30	4.20

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45





OFFICE OF THE

Welsbach Light Co.,

BROAD AND ARCH STREETS,

PHILADELPHIA, PA., June 23, 1899.

To the Stockholders of the Welsbach Light Company:

In answer to the many inquiries received from the stockholders as to whether the Welsbach Light Company is interested in the Kern Light or the Kern Incandescent Gas Light Company, I am authorized by the Board of Directors of this Company to advise you that **THIS COMPANY IS NOT NOW AND NEVER HAS BEEN INTERESTED IN EITHER THE KERN LIGHT OR THE KERN INCANDESCENT GAS LIGHT COMPANY. The Kern Light, or, to designate it more properly, the Kern Bunsen Burner for use with an incandescent mantle, and the United States patents upon which it is based, were offered to this Company, which refused to purchase them upon the advice of its experts, Dr. Charles F. Chandler, of Columbia College, and Dr. Waldron Shapleigh, its Chief Chemist, and of its Patent Council, Mr. John R. Bennett, of New York City.**

This Company is not now and never has been interested in the Welsbach Incandescent Gas Light Company of England, nor is that Company interested in this Company. Your attention is called to the following correspondence, which defines **THE POSITION OF THE UNITED GAS IMPROVEMENT COMPANY,** whose name is mentioned in the advertisements which offer for subscription the stock of the Kern Incandescent Gas Light Company.

WELSBACH LIGHT COMPANY,
W. E. BARROWS, President.

WELSBACH LIGHT CO.,

BROAD AND ARCH STREETS,

PHILADELPHIA, PA., June 23d, 1899.

MR. THOMAS DOLAN, President the United Gas Improvement Company:

DEAR SIR: In yesterday's and to-day's New York and Philadelphia papers appear the advertisements of the International Banking and Trust Company soliciting subscriptions to the Capital Stock of the Kern Incandescent Gas Light Company. Among the names of the Directors of the said Trust Company published in the advertisements referred to appears the name of "George W. Elkins, United Gas Improvement Company, Philadelphia." As the United Gas Improvement Company has been prominently identified with the Welsbach Light ever since its introduction into the United States, the publication of its name in these advertisements, which also contain suggestions hostile to this Company, has greatly disquieted many of our shareholders. If you are willing to give me an authoritative statement of the position of the United Gas Improvement Company I shall be greatly obliged. Very truly yours,

W. E. BARROWS, President Welsbach Light Company.

THE UNITED GAS IMPROVEMENT COMPANY,
Broad and Arch Sts., Philadelphia, June 23d, 1899.

COL. W. E. BARROWS, President Welsbach Light Company:

Dear Sir: Answering your favor of even date, the United Gas Improvement Company is not now and never has been interested either in the Kern Incandescent Gas Light Company or in the International Banking and Trust Company. Mr. George W. Elkins is neither an Officer nor a Director of the United Gas Improvement Company, and does not represent the United Gas Improvement Company. Very truly yours,

THOMAS DOLAN, President,
United Gas Improvement Company.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Under Contract, 1899:

	SETS.	DAILY CAPACITY.
Fostoria, O.	1	250,000 Cubic Feet.
Derby, Conn.	1	750,000 "
Lowell, Mass.	1	1,000,000 "
Doylestown, Pa.	1	50,000 "
Darby, Pa.	1	400,000 "
Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Stapleton, N. Y.	1	750,000 "
London, O.	1	125,000 "
Chicago, Ills.	2	3,600,000 "
Putnam, Conn.	1	125,000 "
Mansfield, O.	1	250,000 "
Plymouth, Pa.	1	125,000 "
Athens, Pa.	1	125,000 "
Charlotte, N. C.	1	250,000 "
Total	23	15,975,000 "
Previously built	294	187,100,000 "
Grand Total	317	203,075,000 "

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

J. H. Gautier & Co.

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Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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Established 1854. Incorporated 1869.

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Water Gas Cupola Linings, Fire Clay, Etc.

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This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

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AND EVERYTHING IN THE FIRE CLAY LINE.

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Works, Weber, N. J.

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Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works, LOCKPORT STATION, PA.

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In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

Eastern Agent, PERRY BORDEN, 19 Prospect Ave., MOUNT VERNON, N. Y.

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Containing 6, 8 or 9 Retorts.

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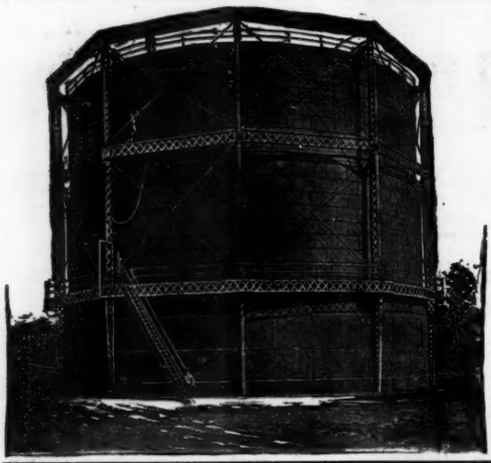

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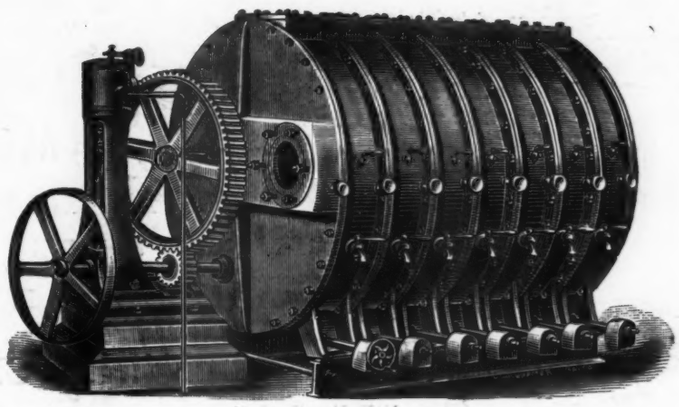

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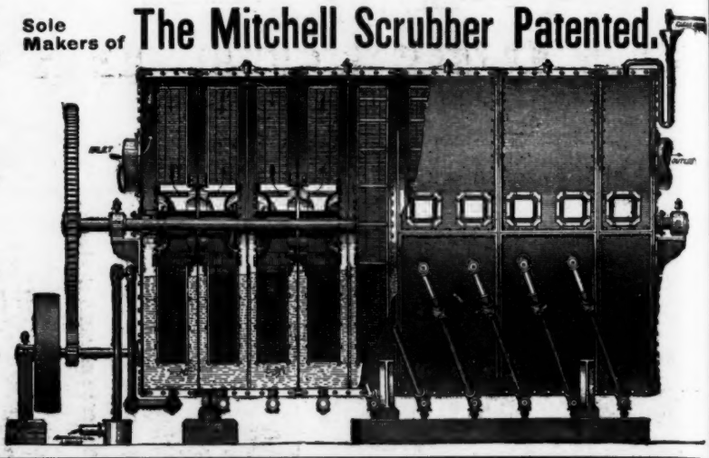

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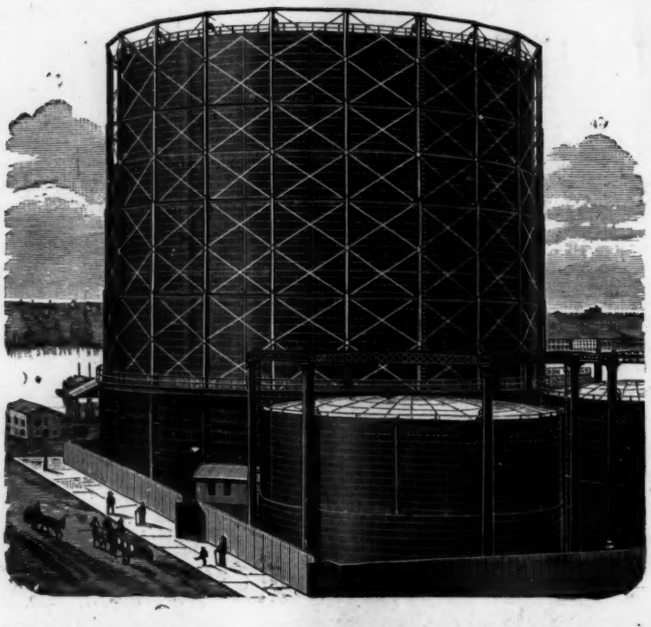

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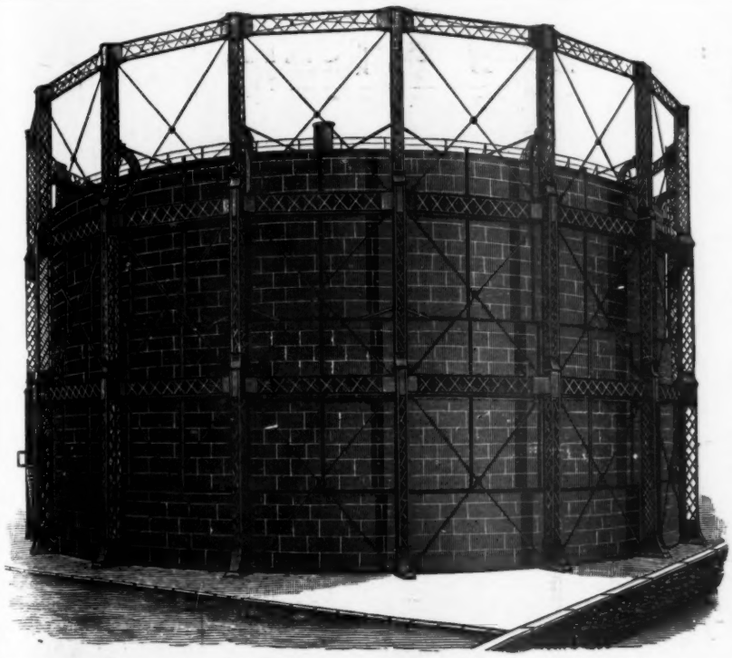

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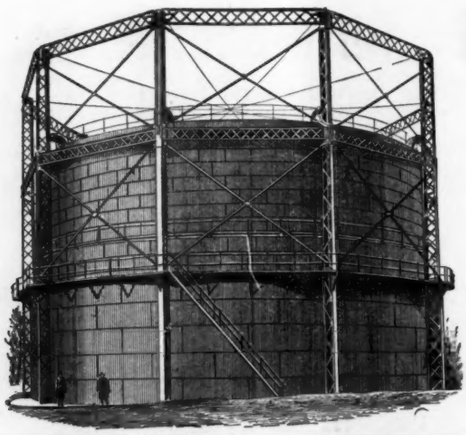

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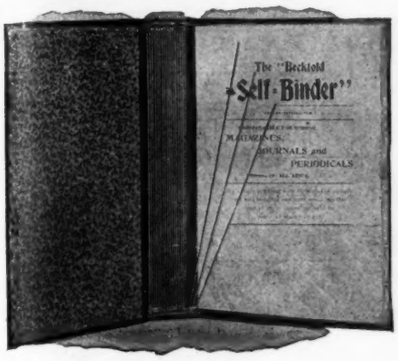

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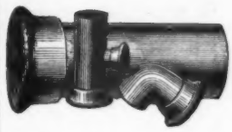

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